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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 5
MARCH 1, 1980

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 5
MARCH 1, 1980

W80-01601--W80-02000

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

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07 RESOURCES DATA

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08 ENGINEERING WORKS

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09 MANPOWER, GRANTS, AND FACILITIES

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10 SCIENTIFIC AND TECHNICAL INFORMATION

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SUBJECT INDEX

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

URBANIZATION AND STREAM QUALITY IMPAIRMENT,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
For primary bibliographic entry see Field 2B.
W80-01685

COMPARATIVE EVALUATION OF STATISTICAL METHOD FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen, W. J. Rawls, and B. L. Whaley.
Water Resources Bulletin, Vol 15, No 4, p 935-947, August 1979. 1 Fig, 3 Tab, 6 Ref.

Descriptors: *Water supply, *Utah, *Forecasting, *Mathematical models, *Evaluation, Model studies, Regression analysis, Correlation analysis, Runoff, Snowmelt, Watersheds(Basins), Precipitation(Atmospheric), Rainfall, Snowfall, Snowpacks, Streamflow, Water resources, Statistis, Statistical methods, Analytical techniques, *Upper Sevier River(UT).

While the correlation coefficient and standard error of estimate are frequently used when comparing models of seasonal water yield, the following criteria may be more important in selecting one model from among several alternatives: rationality of the regression coefficients, the distribution of the residual errors, and the correctness of indicators of the relative importance of the predictor variables. These criteria were used to compare seasonal water yield models that were calibrated using multiple regression, stepwise regression, principal components, polynomial regression using a principal components rotation, and constrained pattern search. Hydrlogic data from the Upper Sevier River basin in southern Utah were used to illustrate the comparative analysis process. The prediction equations used the April-July streamflow volume as the criterion variable. (Sims-ISWS)
W80-01687

A CRITICAL STUDY OF DESIGN FLOOD FOR SURPLUSING WORKS OF MAJOR, MEDIUM AND MINOR IRRIGATION PROJECTS,
Government of Gujarat, Gandhinagar (India).
For primary bibliographic entry see Field 2E.
W80-01802

WATER RESOURCES IN AGRICULTURE: THE ROLE OF SOIL AND WATER IN AGRICULTURAL PRODUCTION AND ENVIRONMENTAL PROTECTION,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
E. T. Engman.
In: Water for Survival, Volume I: Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC, p 266-275, 1979. 4 Fig, 6 Ref.

Descriptors: *Agricultural watersheds, *Model studies, *Hydrology, Demonstration watersheds, On-site investigations, Water balance, Research and development, Agriculture, Water resources, Hydrologic aspects, Water quality, Research programs.

The Agricultural Research Service (ARS) of the United States Department of Agriculture has a unique research program for studying water resources in agriculture. This program is based on a modeling concept that describes the soil and water interactions in complex agricultural watersheds. Currently, research is conducted in 17 major land resource areas and includes measurements of precipitation and runoff on nearly 300 research watersheds. Most field installations include multiple nested watersheds that represent a range of area sizes and topographies. The types of studies made in these areas include routine data collection, controlled experiments of specific processes, various sampling experiments to define model parameters, and applications of remote sensing to define watershed characteristics and model parameters. Recently, with the emphasis on preserving environmental quality, many areas have also been instrumented to conduct mass balances of chemicals, like fertilizers and pesticides. The modeling approach enables ARS to achieve its objectives with a minimum number of empirical studies. This approach may also be equally applicable to a wider range of conditions throughout the world. (Humphreys-ISWS)
W80-01804

CONSIDERATIONS ABOUT THE CLIMATE AND HYDROLOGICAL REGIME IN SOUTHERN AND SOUTHEASTERN BRAZIL,
Parana Univ. (Brazil). Centro de Hidraulica e Hidrologia.
R. H. Andrzejewski.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC., p 314-324, 1979. 5 Fig, 14 Ref.

Descriptors: *Watersheds(Basins), *Climatology, *Hydrologic aspects, *Hydrographs, Seasonal, Streamflow, Data collections, Meteorology, Hydraulic cycle, Hydrologic data, Climates, Precipitation(Atmospheric), Droughts, Floods, Foreign research, *Brazil.

The hydrological and meteorological mechanisms responsible for precipitation and river discharge patterns in Southern and Southeastern Brazil were briefly described. Some characteristics of these mechanisms were used to discuss the spatial correlation between monthly discharges from several basins in southern and Southeastern Brazil. Variation in climate and hydrological regime was discussed both from a mathematical and from a physical point of view. The annual average hydrographs of the study regions were presented. The ones based on the southern streamflow and rainfall data have a little variability all along the year, and the ones based on the Southeastern data show the seasonal hydrological features of this region, with floods in the summer and droughts during the winter. The difference between seasonal aspects of the discharge of the two regions indicates that there must be a certain degree of independence between the hydrological features of these two regions. (Humphreys-ISWS)
W80-01806

SUBSURFACE DRAINAGE FLOWS UNDER NATURAL RAINFALL CONDITIONS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2F.
W80-01807

A SHORT-TERM FLOOD FORECASTING MODEL BASED ON RETENTION HYSTERESIS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01820

ESTIMATION OF WATER BALANCE OF MAHANADI CATCHMENT UPTO HIRAKUD DAM SITE (1962-1966) BY THORNTHWAITE'S TECHNIQUE,
Meteorological Office, New Delhi (India).
S. D. S. Abbi, K. K. Srivastava, and A. K. Malhotra.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 4, p 717-724, October 1978. 6 Fig, 2 Tab, 4 Ref, 1 Append.

Descriptors: *Water balance, *Watersheds(Basins), *Rivers, Runoff, Precipitation(Atmospheric), Rainfall, Monsoons, Soil moisture, Evaporation, Evapotranspiration, Storage, Water storage, Recharge, Hydrology, *India.

A presentation of water balance of Mahanadi catchment up to Hirakud dam site by Thornthwaite's method was made. For this purpose, values for the monthly water deficit, water surplus, soil moisture utilization, and soil moisture recharge for the years from 1962 to 1966 were tabulated and presented graphically. (Sims-ISWS)
W80-01828

GROUNDWATER EXPLORATION AND DEVELOPMENT TECHNIQUES,
Portland Water Bureau, OR.
For primary bibliographic entry see Field 2F.
W80-01836

FLOOD FLOW FREQUENCY BY SCS-TR-20 COMPUTER PROGRAM,
Gilbert/Commonwealth, Jackson, MI. Environmental System Div.
For primary bibliographic entry see Field 2E.
W80-01876

NONPOINT SOURCE POLLUTION CONTROL BY SOIL AND WATER CONSERVATION PRACTICES,
Cornell Univ., Itahca, NY. Dept. of Agriculture Engineering.
For primary bibliographic entry see Field 2E.
W80-01892

2B. Precipitation

URBANIZATION AND STREAM QUALITY IMPAIRMENT,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
R. D. Klein.
Water Resources Bulletin, Vol 15, No 4, p 948-963, August 1979.

Descriptors: *Urbanization, *Water quality, *Steams, Runoff, Erosion, Floods, Pollutants, Construction, Channel morphology, Temperature, Water temperature, Groundwater, Nutrients, Toxins, Fish, On-site investigations, Sampling, Data processing, *Impervious surfacings, Water quality impairment.

A study was conducted in the Piedmont province of Maryland to determine if a relationship exists between stream quality and the extent of watershed urbanization. During the first phase of the study, 27 small watersheds, having similar characteristics but varied according to land use, were investigated. Using these controlled conditions and eliminating as many interferences as possible, this first phase was intended to determine if a definite relationship did exist between the two factors. Finding that the first phase was successful, the second was initiated which consisted of a comparison of biological sampling data, from other studies, with degree of watershed urbanization. The purpose of this second phase was to ascertain if the relationship between degrees of urbanization and decline in steam quality was linear as watershed area increased and in streams spread throughout the Maryland Piedmont. The principal finding of this study was that stream quality impairment is first evidenced when watershed imperviousness reaches 12%, but impairmanent does not become severe until imperviousness reaches 30%. (Sims-ISWS)
W80-01685

COMPARATIVE EVALUATION OF STATISTICAL METHOD FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-01687

SEVERE FLOODS IN KATHIAWAR AND KUTCH CAUSED BY A MID-TROPOSPHERIC DISTURBANCE,
Observatory, New Delhi (India).

Group 2B—Precipitation

C. Ramaswamy, and V. S. Rao.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 4, p 725-730, October 1978. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Flood, *Rainfall, *Precipitation excess, *Meteorology, Weather, Precipitation(Atmospheric), Precipitation intensity, Circulation, Air circulation, Pressure, Atmospheric pressure, Cyclones, Data processing, *India, *Kutch(India), *Kathiawas(India).

This paper contained a description of a quasi-stationary cyclonic disturbance in July 1935 which persisted for about 18 days in the mid-troposphere and caused intermittent, very heavy rainfall leading to severe floods in Kathiawar and Kutch. The importance of this fact-finding study from the point of view of the Monsoon Experiment 1979 was pointed out. (Sims-ISWS)
W80-01826

A STUDY OF WET SPELLS AND PERSISTENCE OF RAINY DAYS IN RAICHUR,
Agricultural Engineering Inst., Raichur (India).
N. Manohar, and B. N. K. Setty.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 4, p 737-740, October 1978. 1 Fig, 3 Tab, 7 Ref.

Descriptors: *Rainfall, *Time series analysis, *Climatology, Climatic data, Data processing, Frequency, Probability, Rain, Statistics, Statistical methods, Persistence, Meteorology, *India.

The rainfall data for 59 years (1917-1975) of Raichur were analyzed to study the wet spells monthwise by applying logarithmic series to find the distribution pattern of rainfall. The frequency of wet spells was estimated for each month from April to December and were in close agreement with observed frequencies. The probabilities of persistence of rainfall on the (r + s)st day, if the rain had occurred on the preceding r days, were also calculated. (Sims-ISWS)
W80-01827

ESTIMATION OF WATER BALANCE OF MAHANADI CATCHMENT UPTO HIRAKUD DAM SITE (1962-1966) BY THORNTHWAITE'S TECHNIQUE,
Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 2A.
W80-01828

FACE RAINFALL RESULT: SEEDING EFFECT OR NATURAL VARIABILITY,
National Oceanic and Atmospheric Administration, Boulder, CO. Atmospheric Physics and Chemistry Lab.
E. C. Nickerson.
Journal of Applied Meteorology, Vol 18, No 9, p 1097-1105, September 1979. 14 Fig, 5 Tab, 11 Ref.

Descriptors: *Weather modification, *Cloud seeding, *Florida, Rainfall, Precipitation(Atmospheric), Data processing, Variability, Silver iodide, Distribution patterns, Statistics, Statistical methods, Meteorology, Cloud physics, Natural variability, Rainfall variability.

An examination of hourly rainfall within areas designated small outside (SO) and large ouside (LO) revealed that prior to the introduction of a new seeding device (NEI) in 1975, average peninsular rainfall on seed (S) days ouside the Florida Area Cumulus Experiment (FACE) target area was slightly less than rainfall on no-seed (NS) days. However, during the NEI period, average station rainfall within the SO area yielded S/NS ratios as high as 3 for the 6 h period following the release of the first flare. Moreover, during the 3 h period to the time of the first seed, average SO station rainfall on seed days exceeded the rainfall on no-seed days by approximately 60%. The large S/NS ratios that occurred outside the FACE target area during the NEI period were not associated with anomalously high rainfall on seed days, but rather with anomalously low rainfall on no-seed days. For the SO area, differences between seed and no-seed samples are highly significant, with one-tailed P values as low as 0.001 as determined from a Wilcoxon (Mann-Whitney) test. Natural variability, therefore, appears to account for statistically significant difference between areawide rainfall on seed and no-seed days. (Sims-ISWS)
W80-01888

RELATION BETWEEN WEST COASTAL RAINFALL AND NIMBUS 6 SCAMS LIQUID WATER DATA OVER THE NORTHEASTERN PACIFIC OCEAN,
Stanford Research Inst., Menlo Park, CA.
For primary bibliographic entry see Field 7B.
W80-01889

COMMENTS OF THE CLIMAX AND WOLF CREEK PASS CLOUD SEEDING EXPERIMENTS,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
P. V. Hobbs, and A. L. Rango.
Journal of Applied Meteorology, Vol 18, No 9, p 1233-1237, September 1979. 3 Fig, 13 Ref.

Descriptors: *Weather modification, *Cloud seeding, *Rocky Mountain Region, *Colorado, Weather data, Data processing, Temperature, Air temperature, Silver iodide, Clouds, Cloud physics, Precipitation(Atmospheric), Snow, Snowfall, Meteorology.

The physical hypotheses for the cloud seeding experiments carried out by Colorado State University in the Colorado Rockies (Climax I and II Wolf Creek Pass) in the 1960's were critically examined. Ariborne measurements over the Rockies have shown that the concentrations of ice particles in the natural clouds are often much greater than originally assumed; consequently, the conditions under which it might be possible to increase precipitation by artificial seeding are probably much more limited than previously supposed. There appears to be no firm evidence to support the contention that 500 mb temperatures are a good measure of cloud-top temperatures over the Rockies. Finally, examination of a moreextensive data set than previously used failed to substantiate eht claim that precipitation over the Rickies decreases as 500 mb temperatures increase above certain values. (Sims-ISWS)
W80-01891

SOME ASPECTS OF THE RELATION BETWEEN MONTHLY TEMPERATURES AND RAINFALL, AND ITS USE IN EVALUATING EARLIER CLIMATES IN THE MIDDLE EAST,
Israel Atomic Energy Commission, Tel-Aviv.
H. L. Striem.
Climatic Change, Vol 2, No 1, p 69-74, 1979. 2 Tab, 2 Fig, 8 Ref.

Descriptors: *Rainfall disposition, *Meteorology, *Correlation analysis, *Hydrologic cycle, *Temperature, *Paleoclimatology, Probable maximum precipitation, Atmospheric precipitation, History, Weather data, Israel.

In the present era, rainfall in the Middle East is associated with the passage of depressions and cold fronts. Using the mean monthly temperature and precipitations at Jerusalem during the hundred years 1861-1960 as published in the World Weather Record (1966) as source material, the author has calculated the average for the whole period and for subperiods to demonstrate that (1) the long-term (100 years) mean monthly precipitations are negatively and, to a first approximation, linearly correlated with temperatures, implying a 13.1 mm increase in monthly precipitation for a decrease of 1 degree C in temperature at Jerusalem, and (2) the inter-annual variations of 30 year subperiods, even with the small changes in temperature and precipitations involved, also show the same basic trend, especially during the coldest and rainiest month of January and February. It is suggestd that this coefficient can be applied, with some qualifications, to the study of rainfall in earlier periods in the Middle East. (Tickes-Arizona)
W80-01950

2C. Snow, Ice, and Frost

COMPARATIVE EVALUATION OF STATISTICAL METHOD FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-01687

2D. Evaporation and Transpiration

PERFORMANCE OF A F.R.P. PAN EVAPORIMETER,
Meteorological Office, Poona (India).
T. R. Rao, and K. S. Rao.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 4, p 701-704, October 1978. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Evaporators, *Evaporation, *Evaporation pans, Energy, Corrosion, Advection, Thermal properties, Copper, Winds, Thermal conductivity, *India, *Fibreglass reinforced plastic pan, Sunken pans, Thermal energy, Shallow lake evaporation, Energy balance, Tank material.

There was no agreement between the performance of a fibreglass reinforced plastic pan and a standard U.S.A., class A pan. Measurements were taken for 14 months on identically exposed and dimensioned pans at the Central Agrimet. Observatory, Pune, India. Differences in their behavior were explained in terms of the thermal properties of the pan. By virtue of the lack of heat exchange with the environment above ground as in the case of a standard class A pan, and by the absence of advection interactions in ground as in the case of a sunken GGI-3000 pan, the fibreglass pan fared better in approaching values of evaporation from a giant sunken 20 sq m tank of 2 m depth. The greatest differences were from 1430 to 1730 IST, and differences were small from 0830 to 1430 IST. (Roberts-ISWS)
W80-01829

SPACE-CORRELATION FIELDS OF PAN EVAPORIMETER NETWORK,
Meteorological Office, Poona (India).
T. R. Rao.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 24, No 4, p 681-685, October 1978. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Evaporimeters, *Networks, *Evaporation, Hydrologic cycle, Water management, Crop production, Crops, Evaporation pans, *India, *Space-correlation fields, *Pan evaporation network, Inter-station correlation, World meteorological organization.

The field of inter-station correlations of pan evaporimeter network of India has been analyzed by seasons. The scale of evaporation phenomenon during various seasons was pointed out in the light of this analysis. Regions where further strengthening of the network density was required were indicated. Correlation-distance relationships were found to be poor in all seasons south of 15 deg N latitude and over a lesser extent throughout the country during periods other than winter. The scale of evaporation field was high in winter when compared to other seasons. It was homogeneous over north and central parts of the country but became less homogeneous towards the south. (Roberts-ISWS)
W80-01831

DEVELOPMENT AND INSTALLATION OF A SIMPLE MECHANICAL WEIGHING TYPE LYSIMETER,
Central Soil and Water Conservation Research and Training Inst., Dehra Dun (India).
S. P. Bhardwaj, and G. Sastry.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 797-802, July-August 1979. 10 Fig, 13 Ref.

Descriptors: *Lysimeters, *Weight, *Evapotranspiration, Crops, Retaining walls, Runoff, Soil moisture, Water seepage, Hydrologic budget, Crop production, *Weighing type lysimeter, *Reinforced concrete structure, Lysimeter tank, Weighing bridge, Soil monolith, Retaining tank.

A simple weighing type lysimeter model fabricated from easily available and indigenous materials was developed. The main components of the assembly were a reinforced concrete structure, dormant platform weigher, lysimeter tank, and retaining tank. The lysimeter tank (120 cm cube) contained an undisturbed soil monolith, had provision for measuring runoff and seepage losses, and was supported by a weighing bridge with a sensitivity of 200 g (0.14 mm of water). The system was quite suitable for water budgeting and evapotranspiration studies on an hourly or daily basis even in remote areas. (Roberts-ISWS)
W80-01890

2E. Streamflow and Runoff

COMPARATIVE EVALUATION OF STATISTICAL METHOD FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-01687

FLOODWAY DETERMINATION COMPUTER PROGRAM.
Soil Conservation Service, Washington, DC. Engineering Div.
Technical Release 64, June 1978. 10 p, 4 Ref, 4 Exhibits.

Descriptors: *Floodways, *Flood profiles, *Computer programs, *Channels, Water conveyance, Open channels, Flood discharge, Rivers, Channel flow, Hydraulics, Data processing, Programs, Flood stages, Water levels.

The Floodway Determination (FLDWY) computer program is used to determine the floodway for flood hazard and flood insurance studies. It is a revision of and replacement for previous HUD-15 programs. A floodway is defined as the minimum width at a cross section that is required to carry the selected (generally 100-year) flood with a specified increase in the water surface elevation. The procedure in the program is based on the equal conveyance reduction concept. No encroachment or narrowing of the channel is allowed. For multiple channels, any overbank segment between channel segments is considered part of the channel. This program does not compute floodways at road sections. An example of an application of the computer programs was presented. (Humphreys-ISWS)
W80-01710

COMPLEX SIMULTANEOUS ANALYSIS OF THE SAVA RIVER AT DIFFERENT HYDROLOGICAL CONDITIONS,
Hydrometeorological Inst. of Croatia, Zagreb (Yugoslavia).
For primary bibliographic entry see Field 5C.
W80-01756

DIET OF BROOK TROUT (SALVELINUS FINTINALIS MITCHELL) AND BROWN TROUT (SALMO TRUTTA L.) IN AN ALPINE STREAM,
Maryland Univ., College Park, Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W80-01770

FLOODPLAIN SERVICES AVAILABLE FROM THE ILLINOIS STATE WATER SURVEY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 10D.
W80-01800

DETERMINISTIC ANALYSIS OF MEXICAN DROUGHTS,
Instituto Technologico y de Estudios Superiores de Occidente, Guadalajara (Mexico), Div. of Civil Engineers.
P. Krausneker.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC., p 97-103, 1979. 2 Fig, 1 Tab, 13 Ref.

Descriptors: *Droughts, *Low flow, *Natural streams, *Watersheds(Basins), Recession curves, Analytical techniques, Analysis, Discharge(Water), Mathematical models, Areal, Foreign research, *Mexico, Un-gaged basins.

Defining drought as low streamflow in natural channels, its deterministic aspect was analyzed by exponential recession curves. Based on daily discharge records of 24 stations in the western central region of Mexico, there were found the specific coefficients for these stations. The coefficients were correlated to the basin areas, thus obtaining a regression formula of the logarithmic type. This formula can help to generate low flow data in order to predict droughts in non-gaged basins. Applications of regression curves on water resources management and the limitations of the deterministic method were mentioned. (Humphreys-ISWS)
W80-01801

A CRITICAL STUDY OF DESIGN FLOOD FOR SURPLUSING WORKS OF MAJOR, MEDIUM AND MINOR IRRIGATION PROJECTS,
Government of Gujarat, Gandhinagar (India).
A. V. Vora.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC., p 185-197, 1979. 4 Fig, 2 Ref.

Descriptors: *Water resources development, *Design flood, *Design criteria, *Floods, Dams, Irrigation, Discharge(Water), Maximum probable flood, Weirs, Peak discharge, Runoff coefficient, Design, Foreign research, *India.

A critical review of the present practice of adopting design flood for major, medium, and minor irrigation projects in Gujarat State, India, was made. By comparing observed floods with design floods, it was pointed out that the design floods have been exceeded 1.5 to 2.7 times, even in the recent past. With the present design, the average cost of head works of major projects is about 60% of total project cost, while the cost for medium projects is about 76%. It was also brought out that only 35% of installed storage capacity is filled for 67% of time for medium projects. It was recommended that the spillways of major and medium projects be designed for 75% maximum probable flood, only. The remaining 25% maximum probable flood may be passed by providing a breaching section. In two cases studied, the cost of breaching section was found to be about 3% of cost of additional spillway. For minor irrigation projects, overdesigning the capacity and taking a calculated risk in areas of poor foundation, as against a completely safe spillway, were recommended as acceptable alternatives. (Humphreys-ISWS)
W80-01802

STEADY SUPERCRITICAL FLOW DOWN AN INCLINED PLANE,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 8B.
W80-01812

AN EXPERIMENTAL STUDY OF HYDRAULIC AND GEOMORPHIC CHANGES IN AN ALLUVIAL CHANNEL INDUCED BY FAILURE OF A DAM,
Colorado State Univ., Fort Collins. Engineering Research Center.
Y. H. Chen, and D. B. Simons.
Water Resources Research, Vol 15, No 5, p 1183-1188, October 1979. 8 Fig, 14 Ref.

Descriptors: *Alluvial channels, *Laboratory tests, *Dam failure, *Geomorphology, Hydraulics, Hydraulic models, Model studies, Sediment transport, Flood stages, Open channel flow, Roughness(Hydraulic).

Dam structures may fail to cause significant changes in the downstream river hydraulics and geomorphology. In this study, basic hydraulic and geomorphic principles were utilized to analyze experimental data to assess changes in flood stage, resistance to flow, and transport of deposited sediment following failure of a dam. Experiments were conducted in a flume with a sand clay bed and a gravel bed. The flume was 8-ft long, 0.4-ft wide, and 0.4-ft high. The thickness of the bed layer was 0.1 ft. In the sand clay bed, the bed layer was cut to form a rectangular channel with a channel width of 0.17 ft and with a sinuosity between 1 and 1.53. There was no sediment deposited behind the dam. The channel slope was approximately equal to 0.0025. Another experiment utilized a gravel bed flume to investigate the effects of transport of sediment deposited behind the dam on the river hydraulics and geomorphology. A relation for determining the induced maximum flood stage considering the river sinuosity was presented. It was found that the river sinuosity increases the river resistance to flow and thus increases flood stage. The presence of the sediment deposited behind the dam can significantly reduce resistance to flow and can affect the river hydraulics after the dam failure. Further studies are required to improve our understanding the interaction between the water and sediment transport and the river stability. (Humphreys-ISWS)
W80-01816

A SHORT-TERM FLOOD FORECASTING MODEL BASED ON RETENTION HYSTERESIS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
M. S. K. Chowdhury, F. C. Bell, and J. R. Learmonth.
Water Resources Research, Vol 15, No 5, p 1121-1129, October 1979. 9 Fig, 20 Ref.

Descriptors: *Flood forecasting, *Retention, *Hysteresis, *Soil water, *Model studies, Mathematical models, Groundwater, Wetting, Drying, Storage, Evapotranspiration, Rainfall, Drainage, Streamflow, Runoff, Watersheds(Basins), Floods.

A mathematical model was developed for the continuous prediction of streamflow from catchment rainfall and evaporation data. It realistically simulates the complex hysteretic interactions controlling the catchment moisture status during wetting and drying phases and satisfactorily allows for the effects of discontinuous and multilayered spatial distributions of soil moisture at any given time. Another important feature of this model is its ability to use the current observed discharge as a state variable, and hence it can be tuned during the operational flood forecasting for better predictions. Although relatively simple components have been adopted for channel flow and other runoff time-distributing aspects, the predicted hydrographs generally agreed well with the recorded hydrographs, particularly for moderate and large floods. (Sims-ISWS)
W80-01820

EXTENSION OF ANNUAL STREAMFLOW RECORD BY CORRELATION WITH PRECIPITATION SUBJECT TO HETEROGENEOUS ERRORS,
Institute of Hydrology, Wallingford (England).
R. T. Clarke.
Water Resources Research, Vol 15, No 5, p 1081-1088, October 1979. 3 Tab, 6 Ref, 1 Append.

Descriptors: *Streamflow, *Precipitation(Atmospheric), *Model studies, *Mathematical models, Rainfall, Rain gages, Networks, Streams, Rivers, Drainage, Flow, Annual, Statistics, Statistical models, Analytical techniques.

Mean annual streamflow, mu sub Y, from a basin must frequently be estimated from short streamflow records. Where longer precipitation records are available, regression methods are commonly used to 'extend' the record of annual streamflow with the objective of improving the precision of the estimate of mu sub Y. However, the longer record of annual precipitation consists of mean areal estimates derived from a network of gages, and each year's estimate will be subject to a within-year sampling error with a variance that is a function of the density of the rain gage network used in calculating it. This paper examined the consequences of neglecting to take account of heterogeneous variance of mean areal precipitation where regression of annual streamflow on annual precipitation is used to improve the precision of the estimate of mu sub Y. (Sims-ISWS)
W80-01823

A NONPARAMETRIC MARKOV MODEL FOR DAILY RIVER FLOW,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
S. J. Yakowitz.
Water Resources Research, Vol 15, No 5, p 1035-1043, October 1979. 3 Fig, 2 Tab, 56 Ref. NSF ENG 76-20280, ENG74-20462, GK35915, GF38183.

Descriptors: *River flow, *Mathematical models, *Model studies, *Markov processes, Flow, Daily, Statistics, Statistical analysis, Analytical techniques, Mathematics, Hydrology, *Cheyenne River(SD).

This paper presented to an audience of research hydrologists what is believed to be a significant new development in time series modeling. The model class is the class of (not necessarily finite state) Markov chains. The basic advantage of this class is that in comparison to parametric models (such as autoregressive moving average) it is a very rich class, and the value of the statistical method described is that, as proven elsewhere, it provides convergence over this large class. The technique was applied to Cheyenne River data, and discussion was provided on how to incorporate prior statistical and geological information into the model. Also, comparisons were made between the nonparametric Markov analysis provided here and the currently popular streamflow models and statistical techniques. (Sims-ISWS)
W80-01825

ANALYTICAL PREDICTION OF NATURAL TEMPERATURES IN RIVERS,
Wyoming Univ., Laramie. Dept. of Mineral Engineering.
For primary bibliographic entry see Field 5B.
W80-01856

FLOOD FLOW FREQUENCY BY SCS-TR-20 COMPUTER PROGRAM,
Gilbert/Commonwealth, Jackson, MI. Environmental System Div.
V. Danushkodi.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No Hy9, Proceedings Paper 14818, p 1123-1135, September 1979. 8 Fig, 4 Tab, 10 Ref.

Descriptors: *Flood frequency, *Frequency analysis, *Computer programs, *Michigan, Floods, Hydrology, Rainfall-runoff relationships, Statistical methods, Watersheds(Basins), Flow, Computers, *Flood insurance studies, Log-Pearson type III analysis.

The Soil Conservation Service Computer Program for Project Formulation--Hydrology reproduces the highest recorded flood hydrograph and estimates statistically reliable flood flows for the North Branch Kawkawlin River in Michigan. The Kawkawlin River consists of two major tributaries with entirely different watershed characteristics. The input data required for this program were collected from topographic maps and field visits. Log-Pearson Type III analysis of the recorded annual peak flows showed that the results of this model compare very well and appear to be entirely within the 90% confidence interval. Variability of the skew coefficient affected by a low outlier was shown. Flows at the gaging station are attenuated by a wide floodplain and do not represent flows at other locations. (Lee-ISWS)
W80-01876

HYDRAULIC GEOMETRY OF ACTIVE GRAVEL RIVERS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
G. Parker.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14841, p 1185-1201, September 1979. 9 Fig, 25 Ref, 2 Append.

Descriptors: *River beds, *Open channels, *Channel morphology, *Bed load, Rivers, Hydraulics, Sediment transport, Analysis, Gradation, *Hydraulic geometry, *Stable channels, Gravel channels, Regime theory, Channel characteristics, Mean annual flow, Size distribution.

The hydraulic geometry of straight reaches of wide, active rivers with beds and banks composed of loose gravel is considered. Naive mechanistic formulations lead to the stable channel paradox; stable width is incompatible with an active bed. A resolution of the paradox based on bed stress redistribution due to turbulent lateral transfer of downstream momentum is outlined and is used to obtain three rationally derived regime relations. These dimensionless relations provide channel properties as functions of bed pavement size and two specified variables; e.g., water and sediment discharge, or water discharge and width. Reduction to relations for hydraulic geometry is shown to require information concerning watershed mechanics that is external to the river, and thus fluvially indeterminate. An empirical relation is determined for this purpose, allowing for derivation of dimensionless relations for hydraulic geometry. (Adams-ISWS)
W80-01878

SHEAR-STRESS DISTRIBUTION IN STABLE CHANNEL BENDS,
Calgary Univ. (Alberta). Dept. of Civil Engineering.
M. A. Nouh, and R. D. Townsend.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY10, Proceedings Paper 14898, p 1233-1245, October 1979. 6 Fig, 8 Ref, 2 Apend.

Descriptors: *Shear stress, *Channels, *Model studies, *Boundary layers, Circulation, Topography, Velocity distribution, Open channel flow, Hydraulics, *Bends(Hydraulic), Bed forms, Boundary shear, Stable channel bends.

A theoretical and experimental investigation was made concerning the relationships between secondary flow phenomena in alluvial channel bends and boundary shear-stress distribution and related stable bed topography generated in the vicinity of same. The physical model, a wide rectangular channel system in which two-dimensional flow conditions were reproduced, incorporated an adjustable bend test section, and bends having central angles of 45 deg, 60 deg, 70 deg were adopted in the study. Particular emphasis was placed on an examination of the secondary circulation decay process along that portion of the straight channel reach immediately following the bend section. Observed stable bed topography within the bend and along the downstream decay zone related favorably to the steady-state boundary shear-stress distributions obtained from a numerical model of the flow field therein. (Lee-ISWS)
W80-01880

GRAVEL SIZE ANALYSIS FROM PHOTOGRAPHS,
Cornell Univ., Ithaca, NY. Dept. of Geological Science.
J. Adams.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY10, Proceedings Paper 14908, p 1247-1255, October 1979. 3 Fig, 10 Ref, 2 Append.

Descriptors: *Sediments, *Streams, *Photography, Statistics, Statistical methods, Hydraulics, Gravels, Beaches, Rivers, Particle size, On-site tests.

Gravel sizes measured from photographs of river beds are biased estimates of size when compared to standard sieve analysis. Mean apparent short axis size (for gravel coarser than 8 mm) from photographs may be converted to sieve equivalent mean size by subtracting 0.1 phi (if mean size in phi units) or multiplying by 1.07 (if mean size in mm). Percentile of the distribution also differ by the same factors. Measures of grain size standard deviation from photographs are approximately equivalent to sieve values. For sizes in phi units the photograph and sieve size frequency distribution curves have similar shape but are offset by the same bias as the mean size. (Lee-ISWS)
W80-01881

NONPOINT SOURCE POLLUTION CONTROL BY SOIL AND WATER CONSERVATION PRACTICES,
Cornell Univ., Itahca, NY. Dept. of Agriculture Engineering.
M. F. Walter, T. S. Steenhuis, and D. A. Haith.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 834-840, July-August 1979. 1 Fig, 6 Tab, 40 Ref.

Descriptors: *Pollution abatement, *Pollutants, *Water conservation, *Soil conservatin, Management, Runoff, Conductivity, Moisture, Conservation, Storage, *Nonpoint pollution, *Pollution control, Conservation practices, Soil adsorption properties, Management practices, Surface storage.

There has been a tendency to equate best management practices, as defined in water quality legislation, with soil and water conservation practices. The effectiveness of soil and water conservation practices at controlling potential pollutants other than sediments depends on the characteristics of pollutants. Pollutants were categorized in groups having distinctly different soil adsorption properties which were related to the effect of soil and water conservation practices on water and soil movement. The effects of all the management practices on loss of pollutants were summarized in table form. The purpose behind categorization of pollutants was to allow a logical means of determining which, if any, management practices would effectively control a given pollutants. Problems occurred with this categorization when chemicals changed their absorption behavior as they degraded or were transformed. (Roberts-ISWS)
W80-01892

THE DILEMMA OF STREAM CLASSIFICATION,
Colorado Univ., Boulder.
R. W. Pennak.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 59-66, 1978. 12 Ref.

Descriptors: *Systematics, *Aquatic habitats, *Lotic environment, *Streams, Brooks, Springs, Rivers, Irrigation ditches, Waste water, Silting, Stream fisheries.

Seven distinctive lotic categories may be designated for the USA: springbrooks, tundra brooks, mountain trout streams, sandy streams, and rivers of the Great Plains, medium to large silted rivers, sewage pollution stretches, and irrigation ditches. Each category includes lotic habitats that are remarkably similar from one part of the country to another. All of the many other kinds of lotic habitats of stretches are grouped together as indistinctive, chiefly because they are so highly variable from place to place and because they defy practical classification. They do not conform to any published single-criterion or several-criteria systems. It is therefore recommended that such waters be characterized by means of a larger cluster of physi-

cal and chemical measurements: width, flow, current speed, substrate, summer temperatures, winter temperatures, turbidity, total dissolved organic matter, total dissolved inorganic matter, water hardness, dissolved oxygen, rooted aquatics, and streamside vegetation. Any two lotic stretches that are similar with reference to these features will have parallel groups of genera and species in their biotic communities. (See also W80-01897) (Otello-Mass)
W80-01899

2F. Groundwater

CALCULATION OF AQUIFER PARAMETERS FROM SPARSE DATA,

Central Water Planning Unit, Reading (England).
A. B. Birtles, and E. H. Morel.
Water Resources Research, Vol 15, No 4, p 832-844, August 1979. 11 Fig, 2 Tab, 16 Ref, 1 Append.

Descriptors: *Model studies, *Aquifer characteristics, *Water levels, *Data processing, Calibrations, Artesian heads, Groundwater movement, Observation wells, Computer models, Transmissivity, Storage coefficient, *England, Inverse problem, Chalk aquifers.

Automatic methods used for the calibration of regional groundwater models are notoriously sensitive to inadequacies in hydrological data used to determine the groundwater regime. The situation is often aggravated by errors introduced by manual interpolation to give estimates of piezometric head between observation boreholes, particularly in areas where these are sparse or locally nonexistent. In this paper a new technique was proposed for the automatic interpolation of groundwater level data that are scattered thinly over a regional aquifer system and the simultaneous determination of transmissivity and storage coefficient distributions. The method makes full use of all available information, and it is consistent with the two-dimensional groundwater flow equations. Results were given to illustrate the success achieved by the method in a practical application. (Visocky-ISWS)
W80-01707

STORAGE COEFFICIENTS FROM GROUND WATER MAPS,

Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W80-01736

SUBSURFACE DRAINAGE FLOWS UNDER NATURAL RAINFALL CONDITIONS,

Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Agricultural Engineering.
S. Ram, H. S. Chauhan, and P. Singh.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resource (8 Vol), Mexico, April 23-27, 1979. International Water Resources Association, Washington, DC, p 325-333, 1979. 3 Fig, 2 Tab, 11 Ref.

Descriptors: *Subsurface drainage, *Subsurface runoff, *Tile drainage, *On-site tests, Hydrographs, Rainfall, Conveyance structures, On-site investigations, Flow, Soils, Hydraulic conductivity, Hydrologic budget, Loam, Silts, Sands, Foreign research, *India, Tile spacing.

Field experiments on subsurface drainage were made in the high water table area of northern humid plains of Himalayan range in India at Pantnagar to study the drainage characteristics under natural rainfall conditions. Tile flow hydrographs for drain spacings of 35, 25, and 15 m and drain depth of 1 m were collectd for a number of natural storms. Average hydraulic conductivity of the soil was 46.6 cm per day. Four typical hydrographs of rainfall depths ranging from 0.6 to 5.15 cm were analyzed to arrive at the following conclusions: (1) The total tile flow considered per unit of drained area was highest in the narrowest spacing. The title at farthest spacing removed the lowest total volume for all the rainfall depths under study. (2) The tile flow as percentage of rainfall depth increased with increase in rainfall depth. The average runoff varied from 12.65 to 53.53% for drain spacings of 35 to 15 m considering the rainfall depth ranging from 1.2 cm to 5.15 cm, respectively. (3) For low rainfall depth of 0.6 cm, the tile flow ranged from 5.55 to 11.2% for drain spacing of 35 to 15 m, indicating that the tile flow tends to even out for lower rainfall depths. (Humphreys-ISWS)
W80-01807

A CASE STUDY OF DRAINAGE INVESTIGATIONS AT GOVERNMENT AGRICULTURAL FARM, HANSI AND ITS ADJOINING AREAS,

Haryana Agricultural Univ. (India).
M. C. Agarwal, R. Kumar, and J. Singh.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washinton, DC, p 386-393, 1979. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Groundwater, *On-site investigations, *Water table, *Drainage, Maps, Water quality, Surface drainage, Water levels, Rainfalls, On-site data collections, Foreign research, *India.

Drainage investigations in area composed of 960 hectares were carried out with a view to assess the existing state, the extent and degree of drainage problems, and to identify exactly when and which areas suffer from unfavorable groundwater conditions. Detailed surveys of groundwater conditions in the area were carried out by installing 76 observation wells in a grid system, and groundwater table depths were recorded once each month from 1973 to 1977. Groundwater contour maps, isobath maps, and quality maps have been prepared for each month. The graphs showing groundwater table conditions for each year were included and discussed. The hydraulic conductivity in situ and transmissibility of soil formation have been estimted. The effect of rainfall pattern and canal water supply schedule on water table fluctuation has also been studied. On the basis of above investigations, it may be stated that there are no serious problems of water logging in the area, and whatsoever little problem exists over a small area close to irrigation canal, especially during the monsoon period, can be ameliorated by providing speedy disposal of excess rainfall by proper surface drainage or by storing rainwater in dugout ponds. The area has good subsurface natural drainage and there is no need for tile drainage. (Humphreys-ISWS)
W80-01808

THE INFLUENCE OF DENSITY DIFFERENCES ON THE DISPERSION PROCESS IN SATURATED POROUS MEDIA,

Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
K. Ambo.
In: Progress Report No 48, p 9-16, April 1979. 6 Fig, 3 Ref.

Descriptors: *Porous media, *Dispersion, *Saturated flow, *Injection, Aquifers, Density, Analytical techniques, Analysis, Groundwater movement, Laboratory tests, Water temperature, Heated water, Dispersion coefficient.

The presence of density differences entirely changes the dispersion process in miscible displacements in saturated porous media. The injection of hot water into heavier cold water and vice versa was studied experimentally. The main results regarding the dispersion process were presented. During an initial period, the dispersion process behaves non Fickian, but after some time, which depends on the physical properties of fluid and porous matrix, dispersion following Fick's law is developed. The resulting dispersion coefficient may be larger by one or more orders of magnitude than the usual coefficient of dispersion. (Humphreys-ISWS)
W80-01810

STREAM DEPLETION BY WELLS IN CASE OF A NON-PENETRATING CONFINING STREAMBED,

Technical Univ. of Denmark, Lyngy. Inst. of Hydrodynamics and Hydraulic Engineering.
O. Stang.
In: Progress Report No 48, p 17-23, April 1979. 2 Fig, 4 Ref.

Descriptors: *Streams, *Withdrawal, *Aquifers, *Groundwatr movement, Model studies, Mathematical models, Theoretical analysis, Analytical techniques, Analysis, Wells, Drawdown, Pumping, Foreign research, *Denmark, Stream depletion.

Since many streams in Denmark and particularly the ones on Zealand are formed in the upper boulder clay deposits, and thus are separated from the main confined aquifers by horizontal semipervious beds, there is a need for a quantitative evaluation of the problem. In order to obtain relatively simple solutions to the groundwater flow problem, the following assumptions were made: (1) The aquifer is isotropic, homogeneous and infinite in areal extent. (2) In cases of unconfined aquifers, the gradients of head are small, so that vertical flow components may be neglected. (3) The transmissivity and storage coefficient remain constant in time. (4) The well is screened over the entire depth of the aquifer and the rate of pumping is constant with time. (5) Water is released instantaneously from aquifer and semipervious beds. (6) The stream of width is considered a mathematical line and is the sole source of recharge. (7) The variation of water level in the stream caused by changes of discharge is neglected. (8) The permeability of the confining streambed is much smaller than the permeability of the aquifer, so that the leakage through the streambed can be considered vertical. It was shown that the derived mathematical model will, for practical purposes, give results of satisfactory accuracy under Danish conditions where wells are often placed relatively close to streams. (Humphreys-ISWS)
W80-01811

THE TRANSITION PROBLEM IN PUMPED AQUIFERS,

Bridgeport Hydraulic Co., CT.
M. L. Johnson, and W. F. Brutsaert.
Water Resources Research, Vol 15, No 5, p 1266-1272, October 1979. 14 Fig, 2 Tab, 8 Ref. NSF ENG 75-10179.

Descriptors: *Aquifers, *Mathematical models, *Groundwater movement, *Water table, Analytical techniques, Analysis, Drawdown, Model studies, Flow, Aquifer characteristics, Finite element analysis, Pumping, Wells, Groundwater, Potentiometric level, Saturated flow, Theis equation, Free surfaces, Pumped aquifers.

Confined aquifers may develop water table conditions near the well bore, and under prolonged pumping stresses, this condition may spread to the recharge area. This situation is defined as the transition problem. The physics of the transition problem was examined by modeling well flow with a finite difference computer simulator. The computer simulator is based on two-dimensional, two-phase flow and takes into consideration formation compressibility, fluid (air and water) compressibility, solubility of air in water, and a seepage face boundary condition at the well bore. A fully implicit finite difference scheme was used to solve the nonlinear flow equations by employing a modified Newton iteration process. The results obtained in this study agreed with field data. Current analytical approaches seem to overestimate drawdown levels in time. The analysis showed that the transition problem is a unique combination of confined and unconfined flow. Gravity flow near the well bore appears to dominate the total flow pattern and affects drawdown at farther distances from the well bore where flow is radial. It was also shown that partially penetrating wells behave much like fully penetrating wells at certain radial distances from the well bore. The numerical simulator can be used in the management of aquifers undergoing transition from confined to unconfined conditions. From an energy conservation viewpoint, water table conditions near the well bore are to be pre-

ferred over preventive measures such as casing off the upper portion of the aquifer. (Humphreys-ISWS)
W80-01814

ANALYSIS OF WATER AND HEAT FLOW IN UNSATURATED-SATURATED POROUS MEDIA,
Kansas State Geological Survey, Lawrence.
M. Sophocleous.
Water Resources Research, Vol 15, No 5, p 1195-1206, October 1979. 14 Fig, 7 Tab, 31 Ref.

Descriptors: *Porous media, *Groundwater movement, *Heat flow, *Model studies, Mathematical models, Saturated flow, Unsaturated flow, Evaporation, Temperature, Heat transfer, Soil water, Hydraulic conductivity, On-site investigations, On-site data collections, Analytical techniques.

This work investigated the theoretical and practical aspects of modeling water and heat flow in an unsaturated-saturated flow domain. Field experiments were designed, and complementary laboratory analyses were employed to measure the relevant physical quantities that would enable the significance of non-isothermal effects to be determined. The Philip and de Vries non-isothermal flow model was adapted to the more general pressure (or matric) head-based approach, and a new expression for the thermal liquid water diffusivity was proposed. A general and versatile computer simulation program for modeling coupled non-isothermal transport was developed. The influence of coupling on diurnal subsurface moisture and heat transfer was evaluated by comparing the isothermal and non-isothermal transient numerical solutions to the heat and water transport problem. The results confirmed that coupling does not noticeably influence the temperature field, but coupling does affect the evaporation and subsurface moisture fluxes. The non-isothermal theory was applied to calculate evaporation from dry land surfaces. (Sims-ISWS)
W80-01815

ANALYSIS OF MASS TRANSPORT WITH UNCERTAIN PHYSICAL PARAMETERS,
Princeton Univ., NJ. Dept. of Civil Engineering.
D. H. Tang, and G. F. Pinder.
Water Resources Research, Vol 15, No 5, p 1147-1155, October 1979. 6 Fig, 1 Tab, 8 Ref, 2 Append. NSF ENG-76-18957.

Descriptors: *Mass transfer, *Groundwater movement, *Model studies, Mathematical models, Groundwater, Permeability, Transmissivity, Soil water, Equations, Dispersion, Physical properties, Analytical techniques, Uncertain parameters.

The coefficients of the mass transport equation are often characterized by considerable uncertainty. Where the functional form of this uncertainty is known, the transport equation can be solved to yield a solution also characterized by uncertainty. The spatial and temporal dependencies of this uncertainty are dependent upon the variance of the velocity and dispersivity, the magnitude of the dispersivity, the functional form of the probability distribution function, and the number of uncertain parameters considered in the analysis. In general the uncertainty, as measured by the coefficient of variation, is considerably smaller for the solution than for the input parameters. While any finite variance theoretically can be accommodated by the method employed for solution of the stochastic partial differential equations, it is nevertheless essential to select numerical parameters (Delta x and Delta t) such that certain constraints on the form of the coefficient matrix are not violated. (Sims-ISWS)
W80-01817

A GENERALIZED SOLUTION FOR SOLUTE FLOW IN SOILS WITH MOBILE AND IMMOBILE WATER,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
F. DeSmedt, and P. J. Wierenga.
Water Resources Research, Vol 15, No 5, p 1137-1141, October 1979. 3 Fig, 1 Tab, 29 Ref. EIA 803565.

Descriptors: *Groundwater movement, *Solutes, *Porous media, *Model studies, Mathematical models, Groundwater, Permeability, Flow, Soils, Mathematics, Equations, Analytical techniques.

An analytical solution was presented for the movement of a solute through a porous medium which is leached at a constant rate. The solution takes into account transfer into an immobile water fraction. The generalized solution is valid for both finite or semi-inifinite media and for concentration or flux type boundary conditions. The solution consists of a convolution integral of two functions. The first function is the derivative with respect to injected pore volume of the corresponding analytical solution of the solute transfer equation without transfer into immobile water. The second function is the J function, for which series approximations were presented. The influence of the boundary conditions on the solution was discussed. (Sims-ISWS)
W80-01818

THE USE OF NATURALLY OCCURRING HELIUM TO ESTIMATE GROUNDWATER VELOCITIES FOR STUDIES OF GEOLOGIC STORAGE OF RADIOACTIVE WASTE,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
I. W. Marine.
Water Resources Research, Vol 15, No 5, p 1130-1136, October 1979. 4 Fig, 4 Tab, 13 Ref. DOE AT(07-2)-1.

Descriptors: *Groundwater movement, *Velocity, *Helium, *South Carolina, Sampling, On-site investigations, On-site data collections, Geochemistry, Isotope studies, Uranium radioisotopes, Geology, Rocks, Crystalline rocks, Groundwater, Gases, Permeability, Radioactive wastes, Thorium.

Most hydrogeologic tests to determine suitable geologic sites for disposal of radioactive waste are of short duration when compared to the time span required in the assessment of the safety of the facility. Geochemical studies of fluid and rock offer an opportunity to examine natural processes that have been going on for a period of time comparable to that required for safe retention of radioactive waste. In a study assessing the potential for storing radioactive waste in metamorphic rock at the Savannah River Plant near Aiken, South Carolina, the rate of water movement was determined to be about 0.06 m/yr by analyzing gas dissolved in the water. The gas contained up to 6% helium, which originated from the radioactive decay of natural uranium and thorium in the crystalline rock. The residence time of the water in the rock was calculated to be 840,000 years from the quantity of uranium and thorium in the rock, its rate of radioactive decay, and the quantity of helium dissolved in the water. From this residence time and a flow path of 51 km, the average velocity of water through the rock was estimated. This water velocity, which is an average over a broad region (51 km) and a long time period (840,000 years), is more applicable to the assessment of a geologic site for storage of radioactive waste than are velocities estimated from packer tests, pumping tests, or artificial tracer tests, all of which require extensive time and space extrapolations. (Sims-ISWS)
W80-01819

A SHORT-TERM FLOOD FORECASTING MODEL BASED ON RETENTION HYSTERESIS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01820

EXPERIMENTAL AND NUMERICAL STUDY OF A TRANSIENT, TWO-DIMENSIONAL UNSATURATED-SATURATED WATER TABLE RECHARGE PROBLEM,
Grenoble-1 Univ. (France). Inst. de Mecanique.
M. Vauclin, D. Khanji, and G. Vachaud.
Water Resources Research, Vol 15, No 5, p 1089-1101, October 1979. 16 Fig, 1 Tab, 19 Ref.

Descriptors: *Groundwater recharge, *Model studies, *Water table aquifers, *Numerical analysis, *Unsaturated flow, *Saturated flow, Infiltration, Trenches, Hydraulic conductivity, Porosity, Unsteady flow, Water transfer, Two dimensional flow, Viscous flow models.

Transient, two-dimensional water flow was studied in relation to the recharge of a water table aquifer. The approach was based on the physics of water transfer in the complete domain defined by both the saturated and unsaturated zones of soil. Experimental data were first obtained in a slab of soil (3 m in length, 2 m in height, and 5 cm in thickness) in which the changes of water content and water pressure occurring in the flow domain were measured throughout an artificial recharge event. These were compared with the predictions of a numerical model based on the continuity of transfer between the unsaturated and saturated zones. The validity of the model was proved by the excellent agreement between simulated and experimental results. Furthermore, comparison with the results obtained by a viscous flow analog revealed the errors associated with the traditional free surface approach, which neglects transfer in the unsaturated zone. (Visocky-ISWS)
W80-01822

DISPERSION IN STRATIFIED POROUS MEDIA: ANALYTICAL SOLUTIONS,
Birmingham Univ. (England). Dept. of Civil Engineering.
A. N. S. Al-Niami, and K. R. Rushton.
Water Resources Research, Vol 15, No 5, p 1044-1048, October 1979. 4 Fig, 2 Tab, 8 Ref, 1 Append.

Descriptors: *Dispersion, *Porous media, *Stratification, *Mathematical models, Equations, Velocity, Flow, Groundwater movement, Density, Theoretical analysis, Analytical solutions.

Analytical solutions were presented for dispersion in stratified porous media. Two different situations were considered, namely, flow parallel to the stratifications and flow perpendicular to the stratifications. Numerical examples were selected to illustrate certain of the trends. (Visocky-ISWS)
W80-01824

THE EFFECT OF WATERTABLE FLUCTUATIONS ON WATER QUALITY: A CASE HISTORY,
Andhra Univ., Waltair (India).
C. S. Rao.
Indian Journal of Meteorology, Hydrology, and Geophysics, Vol 29, No 4, p 691-694, October 1978. 6 Fig, 2 Tab, 6 Ref.

Descriptors: *Water table, *Water level fluctuations, *Water quality, *Salinity, Geochemistry, Geologic control, Chemical reactions, Soil chemistry, Resistivity, Clays, Loam, Cation exchange, Adsorption, *India.

The effect of water table fluctuations on groundwater salinity was observed for three well waters near Visakhapatnam, India. The electrical resistivity of water sample in the well is taken to represent the salinity of water. A correlation between the electrical resistivities of groundwater samples and the corresponding watertable positions over a period of 15 months was brought out. A peculiar in-phase relation between the water level hydrograph and the salinity curve was recorded, the explanation for which was given in terms of the hydrogeology of the layers constituting the 'host' rock. (Visocky-ISWS)
W80-01830

HYDROLOGIC INVESTIGATIONS FOR WATER RESOURCES, WATER POLLUTION AND CIVIL ENGINEERING OPERATIONS USING ISOTOPE TECHNIQUES,
Bhabha Atomic Research Centre, Bombay (India).
U. Chandra, W. Drost, H. Moser, and F.

Neumaier.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 4, p 629-642, October 1978. 11 Fig, 1 Tab, 24 Ref.

Descriptors: *Groundwater, *Groundwater movement, *Isotope studies, Instrumentation, Equipment, Boreholes, Filtration, Seepage, Tracers, Water pollution, Path of pollutants, Water supply, Water resources, Wells, Water wells, Pumping, On-site investigations.

A number of hydrologic studies for groundwater resources, water pollution, and civil engineering investigations were reported. Measuring methods and instrumentation developed lately were outlined. The field studies carried out in alluvils covered investigations for comparison of borehole dilution technique and conventional pumping tests; groundwater supply to an industrial plant; installation of a well gallery for drinking water in a valley; determination of protection zone of a pumping site; pollution of groundwater around garbage dumps and nuclear installations; construction of foundations; seepage from dams; etc. The investigations carried out in fractured and karstic aquifers included field measurements of seepage rates of a dam built in basaltic aquifer and determination of inflow in a karstic well. The possibility of measuring vertical fow of groundwater even in borings in a fractured or karstic aquifer was practically demonstrated. (Sims-ISWS)
W80-01833

ANALYTICAL NOTE--FLUORESCEIN TRACER TECHNIQUE FOR DETECTION OF GROUNDWATER CONTAMINATION,
Bender Hygienic Lab., Albany, NY.
For primary bibliographic entry see Field 5B.
W80-01835

GROUNDWATER EXPLORATION AND DEVELOPMENT TECHNIQUES,
Portland Water Bureau, OR.
R. F. Willis.
Journal of the American Water Works Association, Vol 71, No 10, p 556-561, October 1979. 5 Fig, 4 Ref.

Descriptors: *Groundwater availability, *Oregon, *Aquifer testing, *Exploration, *Borehole geophysics, *Resistivity, Subsurface investigations, Test wells, Water wells, Radioactive dating, Carbon radioisotopes, Cost comparisons, Collector wells, Ring wells, Development techniques.

Many techniques are available for exploring for groundwater and for developing the source when it is located. Groundwater exploration is undertaken when the quantity and quality of the desired water is known, but not where the water is located. Groundwater development is the means by which a known groundwater source is brought into production. Many of the techniques described in this article were successfully employed by the Portland (Oregon) Water Bureau in its recent groundwater exploration and development project. (Visocky-ISWS)
W80-01836

DETERMINATION OF AQUIFER TRANSPORT PARAMETERS,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie.
G. Hibsch, and A. Kreft.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14833, p 1137-1151, September 1979. 2 Fig, 1 Tab, 22 Ref, 3 Append.

Descriptors: *Groundwater, *Dispersion, *Aquifer characteristics, *Groundwater movement, *Analytical techniques, Aquifers, Analysis, Mass transfer, Observation wells, Tracers, Mathematical models, Velocity, Radioisotopes, Dispersion coefficients, Radioactive tracers.

The mathematical simulation of dispersive pollution transport for any groundwater field is possible, provided all physical parameters appearing in the governing partial differential equation are defined. The present work dealt with determining the flow velocity, flow direction, and longitudinal and transverse dispersion coefficients. A use of the multi-well tracer technique with instantaneous input was suggested. An original method for solving the inverse problem was derived. This method provides possibility of simultaneously determining all four above mentioned parameters from the experiment involving only two observation wells. The identification procedure was based upon fitting the analytical linearized model to experimental data. The favorable geometric conditions for setting up the field experiment were given. The method was tested on computer-simulated data sets. (Adams-ISWS)
W80-01877

TARP GROUNDWATER MONITORING, SUMMARY REPORT (OCTOBER, 1976-SEPTEMBER, 1977),
Metropolitan Sanitary District of Greater Chicago, IL. Research and Development Lab.
For primary bibliographic entry see Field 5B.
W80-01896

2G. Water In Soils

STUDIES OF TILLAGE-INDUCED EFFECTS ON HYDRAULIC CONDUCTIVITY.
Purdue Univ., Lafayette, IN. Water Resources Research Center.
S. A. Schroeder, W. C. Moldenhauer, and J. V. Mannering.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-120686, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 117, August 1979. 79 p, 15 Fig, 31 Tab, 54 Ref, 1 Append. OWRT A-050-IND (1).

Descriptors: *Sediments, *Hydraulic conductivity, *Soil management, *Infiltration rates, Suspended loads, Infiltrometer, Soil physical properties, Runoff, Rainfall-runoff relationships, Darcy's Law, Soil aggregates, *Tillage practice, Raub soil, Chalmers soil, Chisel plow, No-till, Conventional tillage.

The infiltration rate of water into soils is a major factor in determining the sediment load of runoff water. This research studied the effects of soil management and tillage practices on several soil types on the rate of infiltration. The purpose was to provide parameter input to an infiltration model which would provide the information for an improved sediment transport model. The study involved two soil types and seven different tillage treatments. The basic infiltration model was a modified Philip's equation. A primary parameter measured was soil moisture conductivity which was done in the field by a method utilizing cumulative surface runoff. Other parameters measured were surface roughness, penetrometer resistance and soil aggregate stability. As with many field infiltration studies, in general there were wide variability of results between replicated plots within a treatment, which made it difficult to arrive at statistical conclusions. There was a trend, however, showing that some of the long term tillage treatments had a positive effect on some soils and aggregate stbility improved the infiltration rate. The method used for estimating the soil moisture conductivity values proved a reliable procedure and was found to be adequate as a parameter in the infiltration equation.
W80-01798

ANALYSIS OF WATER AND HEAT FLOW IN UNSATURATED-SATURATED POROUS MEDIA,
Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 2F.
W80-01815

INFILTRATION AND DRAINAGE CALCULATIONS USING SPATIALLY SCALED HYDRAULIC PROPERTIES,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
A. W. Warrick, and A. Amoozegar-Fard.
Water Resources Research, Vol 15, No 5, p 1116-1120, October 1979. 4 Fig, 2 Tab, 17 Ref. EPA R804751010.

Descriptors: *Infiltration, *Drainage, *Model studies, *Mathematical models, Hydraulic properties, Hydraulic conductivity, Soils, Soil properties, Moisture content, Soil water, Soil water movement, Velocity, Groundwater, Runoff.

Infiltration and drainage results were calculated for spatially varying hydraulic properties. The soil water flow equation was solved in a form valid for scaled soil water characteristics and unsaturated hydraulic conductivities. The single solution was then utilized for individual sites chosen randomly by using a scaling coefficient. This procedure reduced repeated tedious individual calculations to simple algebra or interpolations. Examples included infiltration using semi-analytical forms and drainage based on a single finite difference solution. Monte Carlo simulations were used in most cases. (Sims-ISWS)
W80-01821

THE EFFECT OF WATERTABLE FLUCTUATIONS ON WATER QUALITY: A CASE HISTORY,
Andhra Univ., Waltair (India).
For primary bibliographic entry see Field 2F.
W80-01830

APPARATUS FOR CONTINUOUSLY MEASURING QUANTITATIVE CHANGES IN MOISTURE CONDENSATION AT A SURFACE,
Gesellschaft fuer Strahlen-und Umweltforschung m.b.H., Neuherbert (Germany, F.R.). (Assignee).
C. Bunnenberg, and W. Kuhn.
U. S. Patent No. 4,166,217, 9 p, 5 Fig, 1 Ref; Official Gazette of the United States Patent Office, Vol 985, No 4, p 1005, August 28, 1979.

Descriptors: *Patents, *Measurement, *Moisture, Dew, Condensation, Moisture content, Evaporation, Probes.

The object of the invention is to continuously measure and record, with high sensitivity and accuracy, the natural dew formation on soil and plant substances as well as the evaporation. The measured data is available as electrical signals either digitally or in analog form to be processed accordingly. A continuous measurement apparatus is composed of a dew measuring probe of a natural soil or plant-like material. A radiation source is arranged below the dew measuring probe with respect to the soil surface which emitts beta particles. A beta particle detector faces the radiation source and is located on the opposite side of the dew measuring probe. (Sinha-OEIS)
W80-01997

2H. Lakes

LOW ENERGY MECHANICAL DESTRATIFICATION AND REAERATION OF RESERVOIRS,
Oklahoma Water Resources Research Inst., Stillwater.
J. E. Garton, J. Wilhm, R. E. Punett, D. Barker, and E. Cover.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-115942, Price codes: A05 in paper copy, A01 in microfiche. Final Technical Completion Report, May 1979. 81 p, 16 Fig, 16 Tab, 80 Ref. OWRT C-7603(7250)(1), 14-34-0001-7250.

Descriptors: *Reaeration, *Mining, *Reservoirs, *Thermal stratification, *Destratification, *Methodology, Propeller pumps, Dissolved oxygen, Evaluation.

A cluster of 16 axial flow units was used to destratify a lake having a surface area of 951 hectares. Complete destratification was not achieved. How-

ever, a significant reduction of the anoxic hypolimnion was accomplished. The penetration of a low-velocity jet was limited by density differences and was accurately predicted. Attempts were made to correlate seasonal changes in water near the bottom, the sediments, and physiological changes in benthic invertebrates with the dissolved oxygen content and temperature of the lake water. Examination of the vertical variation of physicochemical conditions indicated that mechanical pumping did not improve water quality of the water 1 m above the bottom at either the 15 m stations in the arms or in the central pool. Particle size decreased with water depth. Organic matter did not vary significantly among stations and seasonal variation was slight. Inorganic phosphorus in the sediment was generally lower in summer than in spring and winter. Phosphorus in the sediments was generally greater at the deeper stations. Minimum sedimentation rates occurred in the central pool. Iron did not show variation with depth. Seasonal trends were observed in sorbed manganese of the sediment. Sediment caloric content decreased significantly throughout the summer. Higher hemolymph ion (Na*, K+, Cl-) concentrations for Chironomus tentans and Chaoborus punctipennis were observed at the deep water stations. Oxygen consumption rates of Chaoborus were highest from those collected at the deep water station. Oxygen consumption increased in the sediment column as the water temperature increased, and the oxygen concentration decreased to 0.0 ppm. (Punnett-Okla)
W80-01601

SELECTIVE WITHDRAWAL AND HEATED WATER DISCHARGE: INFLUENCE ON THE WATER QUALITY OF LAKES AND RESERVOIRS PART II - INDUCED MIXING WITH SUBMERGED, HEATED WATER DISCHARGE,
Wisconsin Univ-Madison. Dept. of Civil and Environmental Engineering.
J. A. Hoopes, P. L. Monkmeyer, N. V. Ionescu, K. V. R. Henkel, and V. Alavian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116270, price codes: A05 in papercopy, A01 in microfiche. Technical Report, Water Resources Center, Univ. of Wisconsin Technical Report, WIS SRC 79-04 1979. 93 p. 14 Fig, 33 Ref. OWRT-B-080-WIS(9), 14-31-0001-3550, 3850

Descriptors: *Reservoirs, *Heated water, *Inflow, Effects, Model studies, Lakes, Ponds, Impoundments, Stratified flow, Destratification, Mixing, Submerged discharge, Heated discharge, Water quality, Hydraulics.

Various methods have been proposed to improve the water quality of stratified lakes and reservoirs. Artificial destratification using pumps, air injection and water jets have been successfully employed. Hypolimnetic aeration has been used to remove chemical stratification, leaving the thermal stratification unchanged. This report presents a field and theoretical investigation of the induced, vertical mixing in a temperature stratified impoundment resulting from the submerged discharge of heated water. This work shows that a subsurface, heated water discharge can induce vertical mixing of a stratified impoundment. The feasibility of and considerations in using this method of mixing along with relations, and procedures for applying the results of this study to an impoundment are presented. General relations are developed for the rate of change of stability in a stratified impoundment due to a heated water discharge, atmospheric energy exchange and impoundment inflows and outflows, for the percent of impoundment mixed, and for the mixing time. A numerical model of an impoundment's temperature structure and changes thereto, resulting from a submerged, vertical, heated water discharge and/or atmospheric energy exchange is presented. The model is in good agreement with observations of the natural temperature distribution (no heated water discharge) in two lakes; model predictions show the changes in the 'natural' temperature distribution for one lake induced by a submerged, heated water discharge. (See also W77-08447)
W80-01604

RISE AND COLLAPSE OF AN INTRODUCED FISH, MORNONE MISSISSIPPIENSIS IN CLEAR LAKE, IOWA,
Iowa State Univ., Ames. Dept of Animal Ecology.
For primary bibliographic entry see Field 5C.
W80-01771

LABORATORY STUDY OF FLOW AND THERMAL STRUCTURES IN HEATED AND/OR COOLED LAYERS OF WATER,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
M. Behnia, and R. Viskanta.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-120694, Price codes: A11 in paper copy, A01 in microfiche. Technical Report No 123, August 1979. 213 p, 76 Fig, 5 Tab, 120 Ref, 4 Append. OWRT B-077-IND (5).

Descriptors: *Thermal stratification, *Energy dissipation, *Energy equation, *Heat transfer, Interferometry, Heated water, Convection, Conduction, Radiation, Cooling, Heat budget boundary processes, Energy transfer.

The purpose was to gain an improved understanding of the basic internal transport processes in natural waters and the interactions at the air-water interface. To this end, thermal and flow structure in a stratified layer of water heated by a radiation source and/or cooled by forced air flow over the surface was studied in the laboratory. The transport processes occurring in impounded waters were imulated in a test cell. The experimental observations during thermal stratification of a shallow layer of water indicated if sufficient radient energy is absorbed at and near the bottom, instabilities will occur. Numerical results based on a transient, one-dimensional energy transfer model showed good agreement with experimental measurements. Heating from below of a nonuniformly stratified layer of water was studied to obtan understanding of turbulent mixing processes in an inherently unstable situation. The predictions from a simple thermal model as well as those from a more sophisticated energy model in which turbulence was accounted for agreed very well with the experimental data for the mixed layer height and temperature. Experimental observation during forced air cooling of a layer of water undergoing thermal stratification by radiation indicated a very complex thermal and flow structure. A model based on conservation principles and turbulence was developed which agreed reasonably well with the experimental data. (Wiersma-Ind)
W80-01799

THE PERFORMANCE OF A WAVE GAUGE IN BUBBLY WATER--WHAT DOES IT MEASURE,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2L.
W80-01809

WINTERTIME RAW-WATER CONTAMINATION AT CHICAGO'S SOUTH WATER FILTRATION PLANT,
Argonne National Lab., IL.
For primary bibliographic entry see Field 5B.
W80-01886

GREAT LAKES TOTAL PHOSPHORUS BUDGET FOR THE MID 1970S,
National Oceanic and Atmospheric Administration, Ann Arbor, MI.
For primary bibliographic entry see Field 5B.
W80-01887

LAKE CLASSIFICATION--GOOD AND BAD,
Arizona State Univ., Tempe. Dept. of Zoology.
G. E. Cole.
In: Classification, inventory, and analysis of fish and wildlife habitat--the proceedings of a national symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 67-68, 1978. 1 Fig, 36 Ref.

Descriptors: *Systematics, *Lentic environments, *Lakes, Limnology, Geology, Soils, Geological regions, Hydrology, Trophic level, Water chemistry, Water circulation.

A need exists for classifying lakes at a regional level and making comparative reference to relevant categories worldwide. Most categories that exist do not apply on a worldwide basis. Lake classifications have been based on at least: geologic origin, edaphic factors, geographic and hydrologic features, trophic status, water chemistry, annual circulation patterns, the morphoedaphic index, and taxonomic schemes involving chemical, geographic, morphologic, and biotic elements. (See also W80-01897) (Otello-Mass)
W80-01900

ASPECTS OF THE ECOLOGY AND PHYSIOLOGY OF FRESHWATER MACROPHYTES: PHOSPHORUS CYCLING BY FRESHWATER MACROPHYTES: THE CASE OF SHAGAWA LAKE,
Minnesota Univ., Minneapolis.
G. B. Lie.
Ph.D. dissertation, 1977. 72 p.

Descriptors: *Aquatic plants, *Plant physiology, *Phosphorus compounds, *Lakes, Plants, Inorganic compounds, Nutrients, Nutrient cycling, Sedimentation, Wetlands, Epilimnion, Hypolimnion, Lake soils, Limnology, Stratification, Lake shores, Littoral.

Phosphorus release and cycling in three aquatic plant types, Sparganium, Nuphar, and Potamogeton species, growing in a lake ecosystem were measured to determine a phosphorus budget for the lake. Loading of phosphorus from the aquatic plants to Shagawa Lake was determined from a plant census to be 6,354 kg P/year. Surveys of the various phosphorus forms in the hypolimnion, epilimnion, and littoral regions of the lake showed that, at certain times during the summer, there was as much orthophosphorus in the littoral zones (10% of the lake by volume) as there was in the rest of the lake. A phosphorus budget computed for the period when the lake was stratified in 1974 indicated that loading by the aquatic macrophytes and other littoral sources could account for changes in phosphorus in both the epilimnion and the subsequent sedimentation to the hypolimnion. (Elowe-Mass)
W80-01914

SEASONAL CHANGES OF PHRAGMITES COMMUNIS TRIN. PART II. MINERAL CONTENTS,
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
For primary bibliographic entry see Field 2I.
W80-01915

FRESHWATER WETLANDS: THEIR NATURE AND IMPORTANCE TO MAN,
Tufts Univ., Medford, MA. Dept. of Biology.
N. H. Nickerson.
Report prepared for New England Environmental Network, The Lincoln Filene Center for Citizenship and Public Affairs, Tufts University, Medford, Massachusetts. 1978. 8 p. 16 Ref.

Descriptors: *Freshwater marshes, *Value, Wetlands, Marshes, Wildlife habitat, Pesticides, Heavy metals, Flood protection, Groundwater recharge.

Wetlands, regardless of size, act in flood prevention and water absorption areas as water dispersal agents, as rechargers of groundwater, as valuable habitat for wildlife during climatic extremes, as denitrifiers of acid rain and excess fertilizers, as adsorbers of heavy metals and pesticides and as supporters of unique flora. (Steiner-Mass)
W80-01928

STATUS OF PRESENT PEATLAND USES FOR AGRICULTURAL AND HORTICULTURAL PEAT PRODUCTION,
Minnesota Univ., Minneapolis. Dept. of Soil Sci-

ence.
R. S. Farnham.
Report prepared for Minnesota Department of Natural Resources, December, 1978. 50 p, 9 Tab, 90 Ref, 2 Append.

Descriptors: *Minnesota, *Peat, *Wetlands, *Census, Horticulture, Arable land, Publications, Land reclamation, Crops, Distribution patterns.

The main emphasis of this study was to evaluate the present uses of peatlands in Minnesota for agricultural and horticultural purposes. In addition, an inventory of current peatland utilization was made including location and extent of peat in state and national forests, in designated state and national wildlife refuges and management areas, recreation areas, natural areas containing peat, and undeveloped peatlands. Information was obtained on the location and extent of the various crops grown on peatlands and data was gathered from farmers concerning major operational problems and current management practices. Peatlands used for commercial horticultural peat production were located on county maps and acreage presently being harvested was determined. A literature survey was made of current agricultural and horticultural uses of peatlands including types of crops, suitability of peatlands, properties of peat, management practices, and problems associated with these developments. Current information on commercial peat production in the U.S. was included and an evaluation made of the potential of Minnesota horticultural peat production in the future. Also, the reclamation potential for mined peatlands was determined. (Steiner-Mass)
W80-01929

2I. Water In Plants

ESTABLISHMENT AND GROWTH OF SELECTED FRESHWATER AND COASTAL MARSH PLANTS IN RELATION TO CHARACTERISTICS OF DREDGED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 2L.
W80-01910

(GROWTH AND CHEMICAL COMPOSITION OF REED (PHRAGMITES AUSTRALLIS) AS RELATED TO WATER EUTROPHICATION), WACHSTUM UND CHEMISCHE ZUSAMMENSETZUG VON SCHILF (PHRAGMITES AUSTRALIS) IN ABHANGIGKEIT VON DER GEWASSEREULTROPHIERUNG.
Technische Univ., Berlin (Germany, F.R.). Inst. fuer Okologie.
For primary bibliographic entry see Field 5C.
W80-01913

ASPECTS OF THE ECOLOGY AND PHYSIOLOGY OF FRESHWATER MACROPHYTES: PHOSPHORUS CYCLING BY FRESHWATER MACROPHYTES: THE CASE OF SHAGAWA LAKE,
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 2H.
W80-01914

SEASONAL CHANGES OF PHRAGMITES COMMUNIS TRIN. PART II. MINERAL CONTENTS,
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
H. Mochacka-Lawacz.
Polskie Archiwum Hydrobiologii, Vol 21, No 3/4, p 369-380, 1974. 10 Fig, 2 Tab, 21 Ref.

Descriptors: *Marsh plants, *Nutrient requirements, *Plant physiology, Wetlands, Lakes, Plant growth, Nutrients, Calcium, Phosphorus.

Mineral contents of parts of reeds were analyzed on six lake reedbeds during two growing seasons. Phenological differences in the contents of particular elements were found, as well as differences between reeds from various sampling grounds and between its morphological parts. In the course of a growing season, the contents of K, Na, P, Fe, and N were decreasing while the amounts of Ca, SiO2, and general ash in dry mass of leaves were increasing. During the biomass maximum of reed, leaves contained most of ash , SiO2, K, and Ca, rhizomes most of Na and Fe and panicles most of P. There were quantitative differences in mineral contents of reed correlated with its distance from the shoreline. The greatest proportion of ash was recorded in reed from shore zones, inundated temporarily. Greater amounts of phosphorus were in general found in stems and leaves of taller reed, with greater biomass, independent of its distance from the shore. (Steiner-Mass)
W80-01915

INLAND HALOPHYTES OF THE UNITED STATES,
Ohio Univ., Athens, Dept. of Botany.
I. A. Ungar.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.), Academic Press, Inc., New York, p 235-305, 1974. 27 Tab, 181 Ref.

Descriptors: *Halophytes, *Marsh plants, *Desert plants, Wetlands, Salt marshes, Marshes, Salt tolerance, Distribution patterns.

Distinct community zonation is often found in inland saline marshes even though physical gradients of moisture, aeration, and salinity may vary continuously. The development of distinct communities seems to be a response to edaphic factors; however, laboratory experiments indicate that halophytes have broader tolerances to salinity than observed in the field. Halophytes are apparently limited to saline extreme environments because they can tolerate low water potentials and not due to a physiological requirement for excess salts. Competitive exclusion may explain their elimination from moderate sites. Even halophytes when near their tolerance limits, respond to increase salinity with a decrease in vigor, density, and cover. Species diversity is lowest in the most saline soils and reaches its maximum in non-saline soils. (Steiner-Mass)
W80-01916

THE EFFECTS OF BISULPHITE AND SULPHATE UPON PHOTOSYNTHESIS IN SPHAGNUM,
Victoria Univ. of Manchester (England). Dept. of Botany.
P. Ferguson, and J. A. Lee.
New Phytologist, Vol 82, p 703-712, 1979. 2 Fig, 4 Tab, 28 Ref.

Descriptors: *Mosses, *Plant physiology, *Photosynthesis, *Bogs, *Air pollution, *Sulfur compounds, Plants, Fens, Wetlands, Pollution, Environmental effects, Air pollution effects, Mires.

Laboratory measurements of photosynthetic oxygen evolution in Sphagnum spp. exposed to varying concentrations of HSO3(-) and SO4(--) indicate that at certain concentrations, photosynthesis may be reduced by 50%. Almost instantaneous reductions induced by HSO3(-), the magnitude of which increased with concentration, were not reversed by additions of HCO3(-). SO3(--) had no effect on oxygen evolution. Effects of HSO3(-) were markedly pH dependent, being much greater at lower pH. Radiocarbon uptake was less sensitive to HSO3(-) than oxygen evolution. Low HSO3(-) concentrations enhanced carbon dioxide fixation but never increased oxygen evolution. Dark carbon fixation was inhibited by 0.1 mM HSO3(-), but enhanced by lower concentrations. (Elowe-Mass)
W80-01917

PHYSIOLOGY OF COASTAL HALOPHYTES,
Chesapeake Research Consortium, College Park, MD.
W. H. Queen.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.), Academic Press, Inc., New York, p 345-353, 1974. 37 Ref.

Descriptors: *Halophytes, *Salt tolerance, *Plant physiology, Wetlands, Marsh plants, Enzymes, Literature.

Recent studies of the dual mechanism of ion absorption have provided significant new insights concerning the adaptation of vascular plants to their highly saline environment. Comparable success has not been achieved in the few investigations of the in vitro response of salt--sensitive enzymes of halophytes to high salt concentrations. Data both supporting and refuting the idea that enzymes of halophytes are more tolerant of high ion concentrations than those of glycophytes have been reported. Results of other studies suggest salt-sensitive mechanisms may be protected by cellular ion compartmentalization. (Steiner-Mass)
W80-01918

ECOLOGICAL SIGNIFICANCE OF FOUR CRITICAL ELEMENTS IN PLANTS OF RAISED SPHAGNUM PEAT BOGS,
Department of Agriculture, Ottawa (Ontario). Plant Research Inst.
For primary bibliographic entry see Field 2K.
W80-01919

ECOLOGY AND RESTORATION OF MANGROVE SHORELINES IN FLORIDA,
Miami Univ., Coral Gables, FL. Dept. of Biology.
H. J. Teas.
Environmental Conservation, Vol 4, No 1, p 51-58, Spring, 1977. 7 Fig, 39 Ref.

Descriptors: *Florida, *Aquatic plants, *Planting management, *Vegetation establishment, Swamps, Marshes, Intertidal areas, Coastal marshes, Plants, Marine plants, Soil-water-plant relationship, Plant physiology, Cover crops, Soil management, Wetlands.

Successful establishment of planted mangroves depends on plant size and source, shoreline energy, root parasite prevalence, tidal depth of planting, substrate type, salinity, and vandalism. Younger plants, particularly seedlings, showed a much greater survival rate than transplanted older plants. Florida mangrove species do not appear to require salt for growth and excessive salinity can cause stunted growth, so fresh water plantings may be successful at some sites. A rough estimate of the cost of planting Red Mangrove propagules on 2-foot centers is $1,000/acre or $2,470/hectare. (Elowe-Mass)
W80-01921

SALT MARSH PLANTS AND FUTURE COASTAL SALT MARSHES IN RELATION TO ANIMALS,
Delaware Univ., Newark. Dept. of Biological Sciences.
For primary bibliographic entry see Field 6G.
W80-01923

VASCULAR HALOPHYTES OF THE ATLANTIC AND GULF COASTS OF NORTH AMERICA NORTH OF MEXICO,
Georgia Univ., Athens. Dept. of Botany.
For primary bibliographic entry see Field 2L.
W80-01924

UPTAKE OF RADIONUCLIDES BY SOME AQUATIC MACROPHYTES OF ISMAILIA CANAL, EGYPT,
Atomic Energy Establishment, Cairo (Egypt). Radiation Protection Dept.
For primary bibliographic entry see Field 5C.
W80-01925

RESPONSE OF WATER SEDGE IN THE GROWTH ROOM TO FERTILIZER AND TEMPERATURE TREATMENTS,
Department of Agriculture, Kamloops (British Columbia). Research Station.
For primary bibliographic entry see Field 2K.
W80-01926

Group 2I—Water In Plants

IRRIGATION OF CROP AND ORNAMENTAL PLANTS WITH SEA WATER,
Ben-Gurion Univ. of the Negev, Beersheva (Israel). Research and Development Authority.
D. Pasternak, J. Ben Dov, and M. Forti.
Report Number BGUN-RDA-220-79, April 1979. 13 p, 1 Fig, 2 Tab, 7 Ref.

Descriptors: *Crop response, *Irrigation effects, *Sea water, *Halophytes, *Forages, *Salt tolerance, Ornamentals, Agrotechniques, Trickle irrigation, Varieties, Proteins, Salinity.

Results of preliminary experiments to determine the growth, yield and quality of fodder halophytes under sea-water irriation and to explore proper agrotechniques for crop production with sea water are reported. The responses to continuous trickle irrigation with sea water of 38 species were observed on a coarse granite sandy soil with very low water holding capcity in a 525 m2 plot in the seashore grounds of the Hebrew University's Marine Laboratory in Eilat, Israel. Preliminary results made over two test periods of 18 and 4 months each indcated that 26 plant species survived and 7 species grow extremely well. It is concluded that these results demonstrated that many plant species can grow well when irrigated with water containing 4.2% salts and that plants such as Atriplex nummularia will reasonable dry matter yields with high protein contest. An initial list of plants which may serve as a basis for gardens irrigated with sea water is compiled based upon these results. (Tickes-Arizo n)
W80-01953

VEGETATION RESPONSE TO A MOISTURE GRADIENT ON AN EPHEMERAL STREAM IN CENTRAL ARIZONA,
Gila Bend High School, AZ. Biology Dept.
D. A. Bloss, and J. D. Brotherson.
The Great Basin Naturalist, Vol 39, No 2, p 161-176, June 30, 1979. 11 Fig, 5 Tab, 67 Ref.

Descriptors: *Crop response, *Ephemeral streams, *Moisture gradient, *Plant populations, *Soil-water-plant relationships, Niches, Channels, Frequency analysis, Vegetation patterns, Speciation, Environmental effects, Varieties, Soil moisture, Flood plains, Slopes, On-site data collections, Arizona.

Vegetational zonation patterns along an ephemeral stream in Central Arizona were studied at 10 sites at half-mile intervals, to determine if such observable patterns represented a continuum adapted to a moisture gradient from slope to stream channel, or if they represented distinct, discrete communities. At each of the 10 sites, five stands were selected, one each on both slopes adjacent to the channel, the flood plain on both sides of the channel, and the stream channel itself. Analysis of frequency data and vegetation patterns indicated that a moisture gradient from mesic to xeric prevailed in the flood plain as well as the slopes, where vegetation sometimes integrated but at other locations maintained sharp delineations. Cluster analysis showed that trees and legumes preferred mid-moisture habitats; forbs, shrubs, and succulents preferred a drier environment; and certain family groups were distributed generally. While diversity increased directly with moisture, being highest on the slopes and lowest in the flood plain, it is believed that disturbance was equally a factor. (Tickes-Arizona)
W80-01957

GERMINATION AND SURVIVAL OF PERENNIAL PLANT SPECIES IN THE MOJAVE DESERT,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
T. L. Ackerman.
The Southwest Naturalist, Vol 24, No 3, p 399-408, Sept 15, 1979. 3 Tab, 26 Ref.

Descriptors: *Soil-water-plant relationships, *Soil moisture, *Water requirements, *Hydrobiology, *Rainfall disposition, *Plant growth, Germination, Perennial plants, Arid lands, Temperature, Desert plants, Viability, Shrubs.

The germination of perennial desert plant species depends principally upon the suitability of both temperature and rainfall, and is generally low in undisturbed arid regions. Reported here are the quantitative results of a study to determine the germination and survival patterns of 11 perennial plant species between 1971 and 1977 in Rock Valley, Nye County, Nevada. In the spring of 1971, 780 permanent quadrants were established to estimate the density of annual plants occupying the area, and 4 quadrants were distributed 10m north, south, east and west of each of 195 randomly distributed points to record the germination of 11 seedling species between 1971 and survival of seedlings until 1977. Results indicated that the species Larrea tridentata and Ambrosia dumosa germinated after rains of 25mm between mid June and Sept., while Atriplex confertifolia, Ceratoides lanata, Ephedra nevadensis, Grayia spinosa and 5 other species germinated between Oct. and March after rains of 16mm. Only one of 201 seedlings which germinated between 1971 and 1975 survived until the spring of 1977. (Tickes-Arizona)
W80-01959

APPARATUS FOR CONTINUOUSLY MEASURING QUANTITATIVE CHANGES IN MOISTURE CONDENSATION AT A SURFACE,
Gesellschaft fuer Strahlen-und Umweltforschung m.b.H., Neuherbert (Germany, F.R.). (Assignee).
For primary bibliographic entry see Field 2G.
W80-01997

2J. Erosion and Sedimentation

AN EXPERIMENTAL STUDY OF HYDRAULIC AND GEOMORPHIC CHANGES IN AN ALLUVIAL CHANNEL INDUCED BY FAILURE OF A DAM,
Colorado State Univ., Fort Collins. Engineering Research Center.
For primary bibliographic entry see Field 2E.
W80-01816

SEASONAL PATTERNS OF ONSHORE/OFFSHORE SEDIMENT MOVEMENT,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2L.
W80-01832

PREFERENTIAL CLAY MINERAL EROSION FROM WATERSHEDS IN THE MAUMEE RIVER BASIN,
Northeastern Forest Experiment Station, Berea, KY.
F. E. Rhoton, N. E. Smeck, and L. P. Wilding.
Journal of Environmental Quality, Vol 8, No 4, p 547-550, October-December 1979. 3 Fig, 4 Tab, 21 Ref.

Descriptors: *Erosion, *Sediments, *Clay minerals, *Ohio, Sampling, Suspended solids, Clays, Expansive clays, Illite, Quartz, Iron, Iron oxides, Cations, Cation exchange, Particle size, Soils, Watersheds(Basins), Sedimentology, *Maumee River(OH).

Runoff sediments and soil surface horizons from 5 small watersheds were characterized for clay mineralogy, particle size distribution, cation exchange capacity, and amorphous and free iron oxide content. The objective was to determine if preferential transport of clay minerals from these watersheds was occurring. Clay mineralogical analysis indicated runoff sediments contained higher concentrations of illite and expandables with lower concentrations of vermiculite and quartz relative to watershed soils. The differences were attributed to preferential transport of fine clays from the soil surface. Runoff sediments contained an average of 18.4% more clay than soil surface horizons. Additionally, the total clay fraction of sediments contained an average of 10.1% more fine clay. Cation exchange capacity increased from 41 meq/100 g for soil clay fractions to 46 meq/100 g for sediment clay fractions due to the increased fine clay content. Both amorphous and free iron oxide contents were lower in the clay fractions of runoff sediments than in the clay fractions of soil Ap horizons. (Sims-ISWS)
W80-01837

SOIL CONSERVATION LIMITATIONS ON REMOVAL OF CROP RESIDUES FOR ENERGY PRODUCTION,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Lab.
M. J. Lindstrom, E. L. Skidmore, S. C. Gupta, and C. A. Onstad.
Journal of Environmental Quality, Vol 8, No 4, p 533-537, October-December 1979. 1 Fig, 6 Tab, 18 Ref.

Descriptors: *Erosion, *Soil erosion, *Erosion control, *Great Plains, *Corn belt, Farm management, Wind erosion, Rill erosion, Sheet erosion, Soils, Crops, Corn(Field), Grain sorghum, Wheat, Oats, Barley, Erosion rates, Crop residues, Residue management, Residue removal.

Potential soil erosion by water for Major Land Resource Areas in the Corn Belt and by wind in the Great Plains was calculated using the Universal Soil Loss Equation and the Wind Erosion Equation for current cropping practices. Crop statistics and components of the erosion equations were obtained from the States Crop Reporting Service, Soil Conservation Service, and information available from related literature. The calculations showed that only limited quantities of residue can be removed safety from either region because of soil erosion potentials. In the Corn Belt, under conventional tillage with all residues removed, only 36% of the cultivated area would have a soil loss at less than the soil loss tolerance level. Residue and tillage management can increase the area adequately protected to 78%. In the Great Plains, only 40 and 56% of the cultivated area produce enough residue to hold soil loss by wind at 6.7 and 11.2 metric tons/ha per year, respectively, when the fields are wide and the soil surface is smooth, i.e., K = 1.0. Increasing soil surface roughness, K = 0.5, increases the cultivated area to 81% where enough residue is produced to maintain a soil loss level of 11.2 metric tons/ha per year. (Sims-ISWS)
W80-01839

APPLICATION OF FORMALDOXIME COLORIMETRIC METHOD FOR THE DETERMINATION OF MANGANESE IN THE PORE WATER OF ANOXIC ESTUARINE SEDIMENTS,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2L.
W80-01841

COMPARATIVE EROSION RATES OF LOESS SOILS IN POLAND AND IOWA,
Science and Education Administration, Columbia, MO.
R. F. Piest, and S. Ziemnicki.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 822-827, 833, July-August 1979. 7 Fig, 3 Tab, 19 Ref.

Descriptors: *Erosion, *Soil erosion, *Loess, *Iowa, Sheet erosion, Rill erosion, Erosion rates, Gullies, Soil types, Particle size, Crops, Farm management, Roads, *Poland.

The erosion consequences of historic land management in the loess hills region western Iowa were evaluated by comparison with similar loess terrain in Poland. Application of the Universal Soil Loss Equation, using inputs based on available cropping, management, topographic, soils, and climatic data, indicated that the Iowa sheet-rill erosion rates are more than double those in Poland, primarily due to the greater rainfall erosivity and field slope length. Gullying is serious at both locations, although present Polish gullying rates are probably less than historic rates and present Iowa rates. (Sims-ISWS)
W80-01853

WHEEL TRAFFIC CONSIDERATIONS IN EROSION RESEARCH,

Science and Education Administration, Morris, MN.
W. B. Voorhees, R. A. Young, and L. Lyles.
Transactions of the American Society of Agricultural Enineers, Vol 22, No 4, p 786-790, July-August 1979. 3 Fig, 5 Tab, 23 Ref.

Descriptors: *Soil erosion, *Soil compaction, *Erosion, *Runoff, On-site investigations, Bulk density, Aggregates, Soil aggregates, Stability, Soil properties, Soil moisture, Soil structure, Agriculture, Wheel traffic.

Recent field experiments in Minnesota showed that wheel traffic from farming operations may compact the soil to a depth of 300 mm or more. This compaction can persist despite tillage, freezing, and thawing. Thus, bulk density, aggregate size and stability, random roughness of the soil surface, infiltration rate, and other erosion-related soil properties are changed. This can cause concentrated areas of different soil properties and drastically alter erosion on research plots. Effects of wheel traffic could bias the erosion results of the actual treatment under investigation. This paper described how wheel-induced compaction may alter erosion results. (Sims-ISWS)
W80-01857

LABORATORY STUDY OF CYLINDRICAL SEDIMENTATION TRAPS,
National Water Research Inst., Burlington (Ontario). Hydraulics Research Div.
Y. L. Lau.
Journal of the Fisheries Research Board of Canada, Vol 36, No 10, p 1288-1291, October 1979. 2 Fig, 5 Ref.

Descriptors: *Sedimentation, *Trap efficiency, *Laboratory tests, *Limnology, Hydraulic models, Testing procedures, Sampling, Flow, Open channels, Reynolds number, Instrumentation, Sediment traps, Cylindrical sediment trap.

Observations of the motion of fluid particles in cylindrical sedimentation traps showed that with an increase of the aspect ratio, there is also an increase in the Reynolds number below which neturally buoyant droplets that were placed near the floor of the trap would remain in the bottom layer. The dependence of the fluid motion on these two dimensionless variables were demonstrated using traps of different diameters. For single cylindrical traps, the experimental results can be used to obtain estimates of the Reynolds number below which resuspension of settled material would not be expected to occur. (Humphreys-ISWS)
W80-01871

SUSPENDED SEDIMENT-PHOSPHORUS RELATIONSHIPS FOR THE INFLOW AND OUTFLOW OF A FLOOD DETENTION RESERVOIR,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W80-01872

PARTICLE-SIZE ANALYSIS BY PIPETTE AND SEDIGRAPH,
Science and Education Administration, Chickasha, OK. Southern Region.
N. H. Welch, P. B. Allen, and D. J. Galindo.
Journal of Environmental Quality, Vol 8, No 4, p 543-546, October-December 1979. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Particle size, *Sediments, *Analytical techniques, Laboratory tests, Methodology, Equipment, Measurements, Regression analysis, Correlation analysis, Bottom sediments, Lake sediments, Sedimentation, Sedimentology, Comparison of methods, Fractionation, Sedimentation methods.

The pipette and SediGraph methods of particle size analyses were compared on 55 samples. The best agreement between the two methods was on 12 of the 55 samples treated to remove organic matter and soluble salts. The correlation for all sizes combined from the 55 samples was 0.97, with a standard deviation from regression of 5.54%. The agreement between the two methods was good at all individual sizes except the % less than 50 micrometers where the correlation was 0.12. Neither method is well suited to particle size analysis of suspended sediment samples with low concentrations or limited quantities of sediment. The major differences between the two methods are the time and labor required to perform the actual analysis and to calculate the analytical results. (Sims-ISWS)
W80-01874

HYDRAULIC GEOMETRY OF ACTIVE GRAVEL RIVERS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01878

GRAVEL SIZE ANALYSIS FROM PHOTOGRAPHS,
Cornell Univ., Ithaca, NY. Dept. of Geological Science.
For primary bibliographic entry see Field 2E.
W80-01881

UNSTEADY FLOW IN STRAIGHT ALLUVIAL STREAMS: MODIFICATION OF INDIVIDUAL DUNES,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
J. Fredsoe.
Journal of Fluid Mechanics, Vol 91, Part 3, p 497-512, 1979. 7 Fig, 2 Tab, 15 Ref.

Descriptors: *Alluvial channels, *Sediment transport, *Dunes, *Mathematical models, Unsteady flow, River beds, Discharge(Water), Channel erosion, Moement, Model studies, Theoretical analysis, Analytical techniques, Bed load, laboratory tests.

Changes in dune properties due to a sudden change in the water discharge were analyzed. The transport of sediment was assumed to occur mainly as bed load, and the square of the Froude number must be much smaller than unity. The theory was based on similarity in the bed-shear distribution close to the dune top just before and just after the change in the water discharge. The model was found to agree with laboratory experiments. Further, by use of this model, flow in a river where the water discharge oscillates weakly around a constant mean value was treated. The variation in the phase differences between sediment transport, water depth, and water discharge with the period of the oscillation was calculated. The results agreed qualitatively with observations. (Humphreys-ISWS)
W80-01893

ERODIBILITY OF SURFACE-MINE SPOIL BANKS IN SOUTHEASTERN OHIO: AN APPROXIMATION,
Ohio State Univ., Columbus. Dept. of Geology and Mineralogy.
C. D. McKenzie, and J. R. J. Studlick.
Journal of Soil and Water Conservation, Vol 34, No 4, p 187-190, July-August 1979. 2 Fig, 4 Tab, 40 Ref.

Descriptors: *Erosion, *Spoil banks, *Strip mines, *Ohio, Sediments, Equations, Model studies, Mathematical models, On-site investigations, Soils, Rocks, Topography, Slopes, Erosion rates, Soil erosion, Mining, *Gallia County(OH).

Meaasurements of accumulated sediment in interbank basins of unreclaimed strip mines determined the average annual soil loss from unvegetated, 18-year-old spoil banks. Assuming the universal soil loss equation (USLE) can be used to estimate sediment yield from strip mine slopes, the topographic factor in the USLE was determined in two ways, and values for erodibility (K) were calculated. The technique is applicable to unreclaimed mines where interbank basins trap all slope-derived sediment. (Sims-ISWS)
W80-01894

2K. Chemical Processes

THE EFFECT OF WATERTABLE FLUCTUATIONS ON WATER QUALITY: A CASE HISTORY,
Andhra Univ., Waltair (India).
For primary bibliographic entry see Field 2F.
W80-01830

NUTRIENT MOVEMENT IN STREAMFLOW FROM AGRICULTURAL WATERSHEDS IN THE GEORGIA COASTAL PLAIN,
Science and Education Administration, Tifton, GA.
For primary bibliographic entry see Field 5B.
W80-01854

CONTAMINATION OF GREAT SMOKY MOUNTAINS TROUT STREAMS BY EXPOSED ANAKEESTA FORMATIONS,
Western Carolina Univ., Cullowhee, NC. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W80-01873

THE EFFECTS OF BISULPHITE AND SULPHATE UPON PHOTOSYNTHESIS IN SPHAGNUM,
Victoria Univ. of Manchester (England). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-01917

ECOLOGICAL SIGNIFICANCE OF FOUR CRITICAL ELEMENTS IN PLANTS OF RAISED SPHAGNUM PEAT BOGS,
Department of Agriculture, Ottawa (Ontario). Plant Research Inst.
E. Small.
Ecology, Vol 53, No 3, p 498-503, Late Spring, 1972. 4 Fig, 33 Ref.

Descriptors: *Peat bogs, Environments, *Aquatic plants, *Sphagnum bogs, Acid bogs, Aluminum, Manganese, Nitrogen, Phosphorus.

The concentrations of N, P, Mn, and Al in plants of two ombrotrophic bogs and four adjacent environments were examined. The current year's foliage of the evergreen bog species, as contrasted with the older leaves, invariably possessed higher concentrations of N and P and lower concentrations of Al and Mn. Within the bog species, the composition of the current year's foliage of the evergreen was not significantly different for any of the elements from that of the deciduous species. Foliage of the bog species was lower in content of N and P than the foliage of plants of other habitats and reflects the paucity of available N and P in the bog substrate. Broad-leaved evergreen leaves of bog plants appear to manufacture more photosynthate per acquired unit of N and P than do deciduous leaves, primarily because of their longevity. The high occurrence of evergreenness in infertile environments may therefore reflect a decreased need to acquire N and P from a substrate deficient in these elements. Mn and Al contents were comparable in the bog plants to plants of other habitats, despite potentially toxic levels of these elements in acid bogs. Apparently many bog plants selectively exclude Mn and Al. (Hinkel-Mass)
W80-01919

RESPONSE OF WATER SEDGE IN THE GROWTH ROOM TO FERTILIZER AND TEMPERATURE TREATMENTS,
Department of Agriculture, Kamloops (British Columbia). Research Station.
W. L. Pringle, and A. L. Van Ryswyk.
Canadian Journal of Plant Science, Vol 45, No 1, p 60-66, January, 1965. 1 Fig, 4 Tab, 10 Ref.

Descriptors: *Fertilizers, *Temperature, *Growth chamber, *Water sedges, Bogs, Wet meadows, Wetlands, Soil, Peat, Soil nutrients.

Water sedge (Carex aquatalis Wahl.), the main component of wet bogs, used for hay in central British Columbia responds under growth-room conditions to a complete fertilizer. Potted sedge-sod plugs were grown for five consecutive cuts (242 days) at temperatures of 70 degrees and 40 degrees F and at light intensities less than 1000 ft/c. Reducing the root temperature from 70 degrees to 40 degrees F, which simulated field conditions, lowered the average yield of all treatments by 45%. Phosphorus appeared to be the most limiting element at both temperatures. Nitrogen gave significant increases only at the lower temperature. The addition of soil nutrients more than doubled the recovery of the same nutrients in the forage from plants grown at both 40 degrees and 70 degrees F as compared with controls. On forage not supplied with P, the Ca/P ratio exceeded 3. (Hinkel-Mass)
W80-01926

2L. Estuaries

REMARKABLE YIELD OF BROWN TROUT (SALMO TRUTTA L.) IN LAKES NEAR THE HARDANGER GLACIER, NORWAY,
Trondheim Univ. (Norway). Museum.
For primary bibliographic entry see Field 5C.
W80-01774

VERTICAL DISTRIBUTION OF FISHES IN ONE LAKE DEEP (LAKE KUUSVESI, CENTRAL FINLAND),
Jyvaskyla Univ. (Finland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W80-01777

POPULATION STUDIES OF VENDACE (COREGONUS ALBULA (L.) AND PERCH (PERCA FLUVIATILIS L.) IN A MESOHUMIC OLIGOTROPHIC LAKE,
Joensuu Univ. (Finland). Karelian Inst.
For primary bibliographic entry see Field 5C.
W80-01779

GENETIC DIFFERENTIATION BETWEEN VENDACE (CORRGONUS ALBULA (L.)) POPULATIONS IN EASTERN FINLAND,
Joensuu Univ., (Finland). Karelian Inst.
For primary bibliographic entry see Field 8I.
W80-01793

THE PERFORMANCE OF A WAVE GAUGE IN BUBBLY WATER--WHAT DOES IT MEASURE,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
J. B. Hansen.
In: Progress Report No 48, p 3-8, April 1979. 4 Fig, 1 Tab, 1 Ref.

Descriptors: *Waves(Water), *Laboratory tests, *Measurement, *Instrumentation, Analysis, Conductivity, Gages, Air entrainment, Water levels, Wave gage, Conductivity wave gage, Breaking waves.

The profile of a foaming wave can sometimes be determined from photos, but when conductivity (or resistance) type wave gages are used for measuring the surface elevations, the influence of the entrained air on the wave gage output must be analyzed further in order to determine precisely what is being recorded. Detailed investigation of the wave gage performance was carried out in a vessel with controlled air entrainment. The investigation showed that a conductivity wave gage used in bubbly water will indicate a surface elevation that lies between the actual surface (with air included) and the surface that would have existed if no air had been present (height of solid water). The wave gage will exaggerate the height of the column of solid water by approximately 20% of the increment in height due to the air present. By inspection of photos of the front of breaking waves, the air content of the most air entrained parts of the laboratory waves is only 2-4% by volume. For laboratory measurements of breaking waves, this means, in general, that measurements yield solid water wave heights exaggerated by less than 1%. (Humphreys-ISWS)
W80-01809

SEASONAL PATTERNS OF ONSHORE/OFFSHORE SEDIMENT MOVEMENT,
Woods Hole Oceanographic Institution, MA.
D. G. Aubrey.
Journal of Geophysical Research, Vol 84, No C10, p 6347-6354, October 20, 1979. 10 Fig, 3 Tab, 11 Ref.

Descriptors: *Sediment transport, *Beaches, *Beach erosion, *California, Seasonal, Erosion, Sedimentation, Shores, Coasts, Waves(Water), Ocean waves, Profiles, Sands, On-site investigations, On-site data collections, Model studies, Mathematical models, Analytical techniques, Eigenfunctions.

Measurements of beach profiles from southern California spanning a 5-year period have been examined for temporal changes in beach configuration. On an annual time scale, the data suggested two distinct seasonal pivotal points separating eroding and accreting regions. Empirical eigenfunction analysis of combined onshore and offshore profiles showed a pivotal point for seasonal onshore/offshore sediment movement at a depth of 2-3 m below mean sea level and suggested another at a 6-m depth. Analysis of accurate reference rod measurements at 4-, 6-, 10-, 14-, and 20-m depths supported the presence of the 6-m pivotal point. A simple model of depth-dependent seasonal sand movement suggested that during initial winter storms, sand is eroded from both the foreshore and from depths of 6-10 m and is deposited in water depths from 2 to 6 m. During less energetic periods, sediment migrates both shoreward (to the beach face) and seaward (to depths of 10 m) from its winter site of deposition (water depths from 2-6 m). This observation of depth-dependent motion contradicts the simple single pivotal point model previously suggested for nearshore seasonal onshore/offshore sediment motion and emphasizes the complexity of nearshore sediment transport. A sediment budget for seasonal onshore/offshore transport, based on the dual pivotal point model, consists of exchanges of 85 cu m/m of beach length across the 3-m pivotal point and 15 cu m/m across the 6-m pivotal point. Over a longer time scale (i.e., the entire 5 years of study), the beaches showed no net erosion or accretion, suggesting that this limited coastal region is stable over these short time scales. (Sims-ISWS)
W80-01832

EDGE WAVES ON COMPLEX BEACH PROFILES,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
R. A. Holman, and A. J. Bowen.
Journal of Geophysical Research, Vol 84, No C10, p 6339-6346, October 20, 1979. 8 Fig, 1 Tab, 18 Ref.

Descriptors: *Beaches, *Waves(Water), *Tides, *Model studies, Mathematical models, Geomorphology, Beach erosion, Coasts, Ocean waves, Topography, Sands, Profiles, Slopes, Beach profiles, Edge waves.

In order to interpret field data in terms of edge wave modes, investigators usually assume that the beach profile is linear, allowing the use of simple analytical solutions for edge wave structure and wavelength. The validity of this assumption was checked by using a numerical model to find the edge wave modes on a typical concave beach. Results showed that estimates of edge wave wavelength using the plane beach assumption can be wrong by + or - 100% at a fixed mean sea level with a further error of + or - 50% introduced by the tides. Greatly improved estimates can be made if the value of beach slope is chosen to reflect suitably the offshore extent of the edge wave. A rule of thumb for calculating the effective beach slope Beta sub e is Beta sub e = h(x')/x', x' = 1/11(2n + 1)L, where h is the water depth at distance x' from shore, L is the edge wave wavelength, and n is the edge wave mode number. The motion of the offshore profile of the edge wave due to a change of tidal elevation is dramatically different on a concave beach than on a plane beach. The tendency for the profile to move offshore for a drop in tide is compensated by the decrease in mean beach slope and hence reduction in wavelength and offshore extent of the wave. For a fixed instrument, a drop in tide may lead to a profile shift onshore or offshore or no shift at all. Edge wave damping on a concave beach was shown to change as a function of tide. At low tide the surf zone width is increased, while edge wave wavelength is decreased, both factors increasing damping. Thus, edge wave spectra taken at low tide may be less energetic than those at high tide, particularly at high frequencies. (Sims-ISWS)
W80-01834

APPLICATION OF FORMALDOXIME COLORIMETRIC METHOD FOR THE DETERMINATION OF MANGANESE IN THE PORE WATER OF ANOXIC ESTUARINE SEDIMENTS,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
P. B. Armstrong, W. B. Lyons, and H. E. Gaudette.
Estuaries, Vol 2, No 3, p 198-201, September 1979. 2 Fig, 2 Tab, 25 Ref. NSF OCE-77-20484, SG 04-8-MOI-79.

Descriptors: *Sediments, *Estuaries, *Pore water, *Manganese, Analytical techniques, Methodology, Chemical analysis, Colorimetry, Sampling, Coasts, Bays, Chemicals, Iron, Chemistry, *Great Bay(NH), Formaldoxime.

The formaldoxime colorimetric method for manganese, previously utilized for freshwater and seawater samples of large volume, was modified for the analysis of small volume, iron-rich sediment pore water samples. Using as little as 3 ml of sample and the addition of EDTA to destroy the Fe-formaldoxime interference (at concentrations of 9 micro-M Mn/l), a precision of 3% was obtained. (Sims-ISWS)
W80-01841

HYPERSALINE BOTTOM WATER: PEARD BAY, ALASKA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
W. J. Wiseman, Jr.
Estuaries, Vol. 2, No. 3, p 189-193, September 1979. 2 Fig, 16 Ref.

Descriptors: *Bays, *Alaska, *Coasts, *Saline water, Sampling, Surveys, Salinity, Temperature, Water temperature, Hypolimnion, Permafrost, Cold regions, Estuaries, *Peard Bay(AK), Hypersaline waters.

Hypersaline bottom conditions have been observed in Peard Bay, Alaska. The water appears to be renewed on an annual basis. Although it does not seem to affect permafrost degradation rates in Peard Bay, similar pools of water along the Beaufort Sea coast could greatly increase the rates of permafrost degradation. Order of magnitude estimates suggest that the hypersaline waters do not become anoxic. (Sims-ISWS)
W80-01842

LIGHT SCATTERING AND EXTINCTION IN A HIGHLY TURBID COASTAL INLET,
Harbor Branch Foundation, Inc., Fort Pierce, FL. Remote Sensing Services.
For primary bibliographic entry see Field 7B.
W80-01843

TIDAL CURRENTS MEASURED NEAR A BRITISH COASTAL POWER STATION,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research

Labs.
J. F. Macqueen, and G. C. C. Parker.
Advances in Water Resources, Vol 2, No 3, p 113-122, September 1979. 5 Fig, 7 Tab, 16 Ref.

Descriptors: *Currents(Water), *Tidal waters, *Coasts, *Powerplants, Water temperature, Cooling water, Thermal polluion, Ocean currents, Circlation, Ocean circulation, Water circulation, Variability, Tides, Data processing, Mathematical models, On-site investigations, On-site data collections.

During the later half of 1975, the Central Electricity Generating Board (CEGB) commissioned a survey of water temperatures and currents in the sea near Sizewell Power Station, which is located on the coast of the southern North Sea some 150 km north-east of London. The survey was performed in coastal waters up to 5 km offshore and spanning an area of about 50 sq km to assist in an estimation of the marine dispersion of heat released with the cooling water discharge from the power station. This paper was larely concerned with varioations in time and space of the residual tidal movements which provide the mechanism for bulk transport of water and, therefore, of heat or other contamininants, from the area. It was shown that these variations can be considerable and this has important implications for far-field models of cooling water discharges. The results of harmonic analysis of the tidal velocity were used in two ways; first, the variation of the current with depth was discussed, and the implications of the mid-field mixing of cooling water were brought out. Second, the significance of reflections from the coast was highlighted by splitting the tidal wave into progressive and standing components. (Sims-ISWS)
W80-01850

ASSESSMENT OF AN AMPEROMETRIC MEMBRANE PROBE FOR DETERMINING FREE RESIDUAL CHLORINE IN SALINE COOLING WATERS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 7B.
W80-01867

TIDAL ENERGY AND SUBLITTORAL MACROBENTHIC ANIMALS IN ESTUARIES,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
D. J. Wildish, and D. D. Kristmanson.
Journal of the Fisheries Research Board of Canada, Vol 36, No 10, p 1197-1206, October 1979. 4 Fig, 9 Tab, 29 Ref.

Descriptors: *Estuaries, *Benthos, *Tidal effects, *Organic matter, Chemical analysis, Water sampling, Currents(Water), Tidal energy, Theoretical analysis, Aquatic animals, Littoral, On-site investigations, Testing procedures, Seston, Sediments, Erosion, Aquatic productivity, Water properties, *Bay of Fundy, Adenosine triphosphate.

A quantitative hypothesis was presented that current velocity and roughness at the sediment-water interface control the numbers, biomass, and growth of suspension-feeding macrobenthic animals. The controls are the effect of tidal currents on turbulent mass transfer of food to suspension-feeding animals and direct inhibition of growth and settlement by currents in excess of 12-30 cm/s. The rate of turbulent supply of Adenosine Triphosphate (ATP) associated with seston was proposed as a practical way of determining growth potentials of suspension-feeding macrobenthos at current velocities less than 30 cm/s. (Humphreys-ISWS)
W80-01868

SEICHE EXCITATION IN PORT SAN JUAN, BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Oceanography.
D. D. Lemon, P. H. LeBlond, and T. R. Osborn.
Journal of the Fisheries Research Board of Canada, Vol 36, No 10, p 1223-1227, October 1979. 4 Fig, 1 Tab, 13 Ref.

Descriptors: *Seiches, *Harbors, *Waves(Water), *Mathematical models, Frequency, Water levels, Fluctuations, Analysis, Analytical techniques, Surges, On-site investigations, Theoretical analysis, Time series analysis, Tidal waters, *British Columbia, *San Juan Harbour.

Seiche motions observed in San Juan Harbour with a bottom-mounted pressure gage were Fourier-analyzed and interpreted in terms of a theoretical model of oscillations in a rectangular basin with an exponential depth profile. Two of the observed periods (at 14.6 and 38.5 min) were identified with resonances of the basin; two other significant low frequency peaks (at 21 and 55 min) do not coincide with resonant periods of the basin and must be due to strong external forcing. Higher fequency fluctuations (20-160 s) are attributed to swell and to its subharmonic interactions with edge waves. (Humphreys-ISWS)
W80-01869

TERRIGENOUS ORGANIC MATTER IN SEDIMENTS OF THE ST. LAWRENCE ESTUARY AND THE SAGUENAY FJORD,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanography Lab.
R. Pocklington, and J. D. Leonard.
Journal of the Fisheries Research Board of Canada, Vol 36, No 10, p 1250-1255, October 1979. 2 Fig, 2 Tab, 40 Ref.

Descriptors: *Estuaries, *Sediments, *Organic matter, *On-site investigations, Gulfs, Organic compounds, Chemical analysis, Methodology, Carbon, Nitrogen, Sands, Lignins, Mud, *St. Lawrence Estuary, *Saguenay Fjord, Pelites.

The purpose of this study was to interpret chemical analyses of surficial sediments in the St. Lawrence Estuary and the Saguenay Fjord in terms of the contribution of land-derived organic matter to the sediments. A set of over 200 samples, representative of all regions within the Gulf of St. Lawrence, shows organic carbon and nitrogen in the surface sediments to be lognormally distributed. Organic matter is related to sediment texture. Of the two major classes of sediment in the Gulf, pelites (muds) have a significantly higher and less variable organic carbon and nitrogen concentration than sands. Pelites in the Saguenay and Humber fjords have higher and more variable organic carbon content than pelites elsewhere, but they have lower and more variable nitrogen. The concentration of organic nitrogen is highest in pelites in the Gulf and lowest in sands, particularly those farthest from the ocean. The proportion of land-derived organic matter in sediments of the upper St. Lawrence Estuary is unexpectedly low. In the Saguenay Fjord and the lower estuary, high organic carbon to nitrogen ratios and the presence of lignin indicate a substantial contribution of organic matter from terrestrial sources. The proportion of terrigenous organic matter decreases rapidly thereafter, approaching levels typical of marine sediments in the open Gulf. (Humphreys-ISWS)
W80-01870

TIDAL FLOWS IN SALT MARSH CREEKS,
Cambridge Univ. (England). Dept. of Geography.
T. P. Bayliss-Smith, R. Healey, R. Lailey, T. Spencer, and D. R. Stoddart.
Estuarine and Coastal Marine Science, Vol 9, No 3, p 235-255, September 1979. 11 Fig, 5 Tab, 38 Ref.

Descriptors: *Salt marshes, *Tidal streams, *Tidal effects, *Geomorphology, Tidal marshes, Streams, Tides, Flow, Frequency, On-site investigations, On-site tests, Data collections, Analysis, Foreign research, Velocity, Currents(Water), Marshes, Floods, Methodology, Water levels, Flood stages, *England.

Tidal flows in salt marsh creeks must control both creek morphology and the overall sediment and nutrient budgets of the marsh, but little is known of the magnitude and frequency of such flows. Data were presented in this paper from north Norfolk, England. The data indicated a threefold division of the tidal-flow regime. On Upper marshes the majority of tides are 'below-marsh', and, apart from a small initial pulse of velocity on the flood, they generate only modest flows in creeks. The level of the marsh surface provides a threshold at which, with higher 'marshfull' tides, velocities can increase to reach peaks shortly before and shortly after high tide. These velocity pulses are greater on the ebb than on the flood, but the flood pulse occurs at a higher stage. The even higher but infrequent 'over-marsh' tides, often associated with storm surges, have a substantial flood maximum in both velocity and discharge. It was hypothesized that only these extreme tides might be capable, on upper marshes, of achieving significant erosion and deposition, and that their much higher frequency on lower marshes may account for the observed rapidity of geomorphic change at this earlier stage in salt marsh development. (Humphreys-ISWS)
W80-01882

RESIDUAL FLUXES OF WATER AND SALT AT TWO STATIONS IN THE SEVERN ESTUARY,
Institute for Marine Environmental Research, Plymouth (England).
R. J. Uncles, and M. B. Jordan.
Estuarine and Coastal Marine Science, Vol 9, No 3, p 287-302, September 1979. 6 Fig, 2 Tab, 13 Ref.

Descriptors: *Estuaries, *Water circulation, *Tidal waters, *Mathematical models, Salt balance, Water balance, Salinity, Model studies, Foreign research, Currents(Water), Analysis, Analytical techniques, Diffusion, On-site tests, Water properties, On-site data collections, Tidal effects, Flow, *United Kingdom, *Severn Estuary.

Observations of currents and salinity were presented for two stations in the Severn Estuary. The observations extended over 50-h periods at both stations, and the data were analyzed to provide estimates of the residual fluxes of water and salt. Relative to the depth averaged values, the axial residual currents show a seaward flow in the upper layer, and a landward flow in the bottom layer for both stations; the associated salinity profiles show only small differences in salinity between the seabed and the sea-surface (equivalent to 0.1 parts per thousand). The tidally averaged velocity and salinty profiles were used to estimate the effective vertical eddy viscosity and diffusivity which are applicable to residual variables, estimated maximum values being of the order of 50 and 100 cm sq/sec, respectively. The computation of residual fluxes showed that the Stokes drift is an important feature of the physical regime of the Severn Estuary. The residual transport of water is the dominant mechanism for the residual transport of salt, of which the transport effected by tidal pumping is of the same order of magnitude as the salt transport due to freshwater discharges into the estuary; the vertical shear appears to be of secondary importance in the salt balance of the estuary. (Humphreys-ISWS)
W80-01883

TIDAL AND SEASONAL VARIATIONS OF TRACE ELEMENTS IN TWO CORNISH ESTUARIES,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
C. R. Boyden, S. R. Aston, and I. Thornton.
Estuarine and Coastal Marine Science, Vol 9, No 3, p 303-317, September 1979. 3 Fig, 5 Tab, 13 Ref.

Descriptors: *Estuaries, *Tidal effects, *Trace elements, *Water pollution, Metals, Water pollution sources, Arsenic, Copper, Lead, Zinc, Nickel, Cobalt, Cadmium, Manganese, Tidal waters, Foreign research, Pollutants, Bottom sediments, Suspended solids, Dissolved solids, On-site investigations, Sampling, Analytical techniques, Water properties, Salinity, Water temperature, Runoff, *England.

Tidal and seasonal changes in trace element concentrations were studied in solution, suspended particulates, and bottom sediments at locations in two Cornish estuaries. The two estuaries chosen for study represented moderate and severe degrees of contamination by metals including arsenic,

copper, lead, tin, and zinc. Results showed that considerable differences in concentrations and behavior of trace elements occur on a tidal and seasonal basis. These differences have been related to the influences of fresh-water input from mineralized catchments and were discussed in terms of mixing of runoff with saline waters during diurnal and annual cycles. (Humphreys-ISWS)
W80-01884

SEDIMENT HYDROCARBONS NEAR AN OIL RIG,
Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry.
For primary bibliographic entry see Field 5B.
W80-01885

ESTABLISHMENT AND GROWTH OF SELECTED FRESHWATER AND COASTAL MARSH PLANTS IN RELATION TO CHARACTERISTICS OF DREDGED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
J. W. Barko, R. M. Smart, C. R. Lee, M. C. Landin, and T. C. Sturgis.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-039 495, Price codes: A03 in paper copy, A01 in microfiche. Technical Report D-77-2, March, 1977. 41 p, 36 Ref.

Descriptors: *Marsh plants, *Spoil banks, *Vegetation estabishment, Wetlands, Dredging, Plant growth, Rhizomes, Root systems, Nitrogen, Saline soils, Marshes, Productivity.

An investigation of the success of establishment and growth of marsh plants on physically and chemically different dredged sediments was conducted under semi-controlled conditions in a greenhouse. Growth of freshwater plants was affected by the availability of nitrogen and was significantly greater on fine-textured sediments than on sand. Growth of both brackish and salt marsh plants was relatively unrelated to nutrient availability, and was most affected by the salinty of the sediment solution. Within the same period of growth, transplants produced plant populations having greater biomass and numbers of stems than did any of the other plant propagules. Rhizomes, rootstocks, and tubers responded similarly, but to a lesser extent, to sediment differences than transplant propagules of the same species. (Steiner-Mass)
W80-01910

PHYSIOLOGY OF COASTAL HALOPHYTES,
Chesapeake Research Consortium, College Park, MD.
For primary bibliographic entry see Field 2I.
W80-01918

EFFECTS OF HERBICIDES ON THE SPARTINA SALT MARSH,
Auburn Univ., AL. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 4C.
W80-01920

ECOLOGY AND RESTORATION OF MANGROVE SHORELINES IN FLORIDA,
Miami Univ., Coral Gables, FL. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-01921

SALT MARSH PLANTS AND FUTURE COASTAL SALT MARSHES IN RELATION TO ANIMALS,
Delaware Univ., Newark. Dept. of Biological Sciences.
For primary bibliographic entry see Field 6G.
W80-01923

VASCULAR HALOPHYTES OF THE ATLANTIC AND GULF COASTS OF NORTH AMERICA NORTH OF MEXICO,
Georgia Univ., Athens. Dept. of Botany.
W. H. Duncan.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.), Academic Press, Inc., New York, p 23-50, 1974. 59 Ref.

Descriptors: *Halophytes, *Marsh plants, *Atlantic coastal plain, *Gulf coastal plain, Wetlands, Salt marshes, Marshes, Coastal marshes, Habitats.

Difficulties in deliminting halophytes and halophytic habitats are discussed and an annotated list of halophytes presented. Data included for each species are: the halophytic habitats in which they are reported to occur, the authors reporting the habitats, page citations for these reports, and composites of the coastal geographic distributions compiled from numerous authors. The list of halophytes includes 347 species in 177 genera and 75 families. The possibilities that some species may be erroneously listed and others apparently omitted are discussed. Geographic distributions are analyzed by areas and summarized. The most species, 197, occur in the area from Georgia into Delaware. Thirty-eight occur in Florida, 17 only in Canada, and 32 in every one of the coastal states from Texas into Canada. Habitat terminology lacks uniformity. (Steiner-Mass)
W80-01924

A MODELING APPROACH TO EVALUATE TIDAL WETLANDS,
Gruman Ecosystems Corp., Bethpage, NY.
D. Hill.
In: Transactions 41st North American Wildlife and Natural Resource Conference, March 21-25, 1976, Washington, DC, p 105-117. Wildlife Management Institute, Washington, DC, 1976. 2 Fig, 1 Tab, 14 Ref.

Descriptors: *Salt marsh, *Model studies, *Marsh management, *Eocnomics, *Evaluation, *Income, Wetlands, Mathematical models, Decision making, Costs, Natural resources, Alternative costs, Social values, Cost allocation, Water allocation(Policy).

A resource allocation model of the linear programming type was devised to provide an economic evaluation ofwetlands. Exercise of the model shows the values that are inputed to wetlands by alternative resource management decisions. The model consists of a set of equations that define the biological, physical, chemical, and economic boundaries on the possible uses of a hypothetical bay. With these equations, the combination of uses is determined that maximizes the value of the objective function, the components of which are annual net income (in dollars), the environmental value, and the social value. Finding the maximum dollar value (or, equivalently, the minimum cost) of this complex of uses identifies those that give the salt marsh its greatest monetary value. The annual dollar value of the salt marsh is determined to the extent to which it contributes to net income or reduces the need for costly alternatives. No distinction is made in this model between income that results from using the wetland and that which results from destroying it; the typical year considered is assumed to extend into the indefinite future. (Steiner-Mass)
W80-01927

ZOOPLANKTON DISTRIBUTION IN RELATION TO THE HYDROLOGY OF THE DERWENT RIVER ESTUARY,
Tasmania Univ., Hobart (Australia). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W80-01985

MATHEMATICAL MODELLING OF EUTROPHIED COASTAL AREAS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
For primary bibliographic entry see Field 5C.
W80-01993

WATER CONDITIONS IN THE STOCKHOLM ARCHIPELAGO AFTER THE INTRODUCTION OF BIOLOGICAL AND CHEMICAL PURIFICATION OF WASTE WATER,
Stockholm Water and Sewerage Works (Sweden).
For primary bibliographic entry see Field 5C.
W80-01994

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PROCESS FOR DE-SALTING OF WATER AND APPARATUS FOR PERFORMING THIS PROCESS,
G. Mach.
U.S. Patent No 4,167,480, 5 p, 3 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 986, No 2, p 411-412, September 11, 1979.

Descriptors: *Patents, *Desalination, *Demineralization, Reverse osmosis, Semipermeable membranes, Membrane processes, Magnetic fields.

A process is described for desalting water by passing a stream of water to be desalted to a reverse osmosis system having a high pressure chamber which receives the stream of water to be desalted and which discharges a stream of water enriched in salt and having semipermeable membrane means through which essentially desalted water passes from the high pressure chamber to a desalted water chamber. Prior to is passage through the semipermeable membrane means, the stream of water is passed through at least one magnetic field so that clogging of the pores of the semipermeable membrane is reduced. The arrangement can be such that magnets are applied to the outer side of the supply conduit and are applied at diametrically opposed areas of this conduit. This provides the advantage that the magnetic field is mainly crossing at a right angle the path of flow of the water to be desalted. (Sinha-OEIS)
W80-01951

3B. Water Yield Improvement

CRITICAL APPRAISAL OF WORK DONE ON WATER HARVESTING SYSTEMS,
Udaipur Univ. (India). Coll. of Technology and Agricultural Engineering,
M. T. Deshmukh.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC., p 256-265, 1979. 2 Tab, 26 Ref.

Descriptors: *Water harvesting, *Water yield improvement, *Water storage, Watersheds(Basins), Design, Runoff, Rainfall, Foreign research, Water utilization, *India.

Work done on water harvesting was critically appraised, taking into consideration various aspects of a system such as (1) water harvesting concepts, (2) water harvesting catchments, (3) runoff storage structures, (4) types of storage, (5) location of storage, (6) economic water storage, (7) design of the system, and (8) utilization of harvested water. Based on the appraisal of the work, tables were prepared and tabulated for Udaipur region of Rajasthan, India, for selecting suitable size of catchment and storage. (Humphreys-ISWS)
W80-01803

3D. Conservation In Domestic and Municipal Use

WATER-FLOW CONTROL DEVICE,
T. L. Merritt.
U.S. Patent No 4,161,965, 4 p, 5 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 4, p 854, July 24, 1979.

Descriptors: *Patents, *Water conservation, *Control, Flow control, Domestic water, Equipment, Shower heads.

A water-flow control device for shower heads is adapted to be positioned within the shower supply pipe adjacent the shower head so that the water-flow rate is considerably reduced and the varying pressure flow is automaticaly compensated. The device is comprised of a unitary body of resilient material having a central longitudinal bore to permit passage of water. The receiving end of the body is formed with a pair of oppositely inclined walls having a slot defining movable shoulders which are inwardly flexed under high-flow conditions thereby restricting water flow through the central bore. (Sinha-OEIS)
W80-01949

3F. Conservation In Agriculture

A MULTI-DISCIPLINARY APPROACH TO THE RECLAMATION OF IRRIGATION SCHEMES IN CENTRAL IRAQ,
Food and Agriculture Organization of the United Nations, New York.
J. G. Pike, and A. K. Mitra.
Journal of the Institution of Water Engineers and Scientists, Vol 31, No 3, p 175-186, May 1977. 2 Fig, 7 Ref.

Descriptors: *Irrigation, *Reclamation, *Central Iraq, *Multidisciplinary approach, *Project planning, Agriculture, Topography, Drainage, Climate soils, Water resources, Design, Management surveys, Linear programming, Optimization, Cropping patterns, Benefit maximization, Investment, Water utilization, Farming systems, Systems analysis, Feasibility.

Iraq needs to improve agricultural production to feed a growing population. Land deterioration in the central alluvial plain necessitates carefully planned large-scale reclamation schemes, calling for an integrated multidisciplinary approach to investigate problems imposed by the existing irrigation and farming system and by the adverse natural conditions, all of which limit the choice of alternatives and options. Discussed herein are: (1) irrigation in Central Iraq; (2) the Greater Mussayib Project, its topography, soils, climate, water resources, irrigation and drainage system, and irrigated farming system; (3) project investigations, including objectives, a farm management survey, and optimum farming systems and cropping patterns by linear programming; (4) development proposals, considering irrigation and drainage, farm development and infrastructure; and (5) investment feasibility. It is concluded that project studies need to assess the existing farming system's resources and ability to bring about changes. The core of the investigation is to mount a farm management survey at an early stage, from which technical data, farming systems, and benefit-maximized cropping patterns and water requirements may be determined. This would yield criteria for redesigning the irrigation and drainage network, infrastructure and institutions. (Bell-Graf--Cornell)
W80-01695

CONSERVING SUPPLEMENTAL IRRIGATION WATER APPLIED TO SOYBEANS,
Mississippi State Univ., Mississippi State. Dept. of Agronomy.
F. D. Whisler, and H. F. Hodges.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119936, Price codes: A03 in paper copy, A01 in microfiche. Report, October 1979. 28 p, 16 Tab, 12 Ref. OWRT A-121-MISS (1), 14-34-0001-9026.

Descriptors: *Growth stages, *Moisture stress, *Soil-water-plant relationships, *Soybeans, *Supplemental irrigation, *Timing, *Water management(Applied), Crop production, Environmental effects, Irrigation effects, Irrigation practices, Moisture uptake, Nuclear moisture meters, Plant growth, Tensiometers, Transpiration, Water conservation, *Leaf diffusive resistance, *Plant water potential, *Soil water potential, 100 seed weight.

In order to conserve or use most wisely agricultural water supplies as supplemental irrigation to natural rainfall, knowledge of when to irrigate, how much to irrigate and what are the plants' responses to water stress are needed. Studies to answer parts or all of these questions for soybeans were conducted in 1978 and 1979 at the Blackbelt Experiment Station near Brooksville, Mississippi and at the Plant Science Farm at Starkville, Mississippi. Field plots at the Blackbelt Station were covered with plastic with trickle irrigation beneath the plastic to control the soil moisture on some of the stressed plots. Large (76 1) containers were used at the Plant Science Farm to control a high water table condition. Plastic covers and irrigation beneath the plactic was used on some containers to induce stress when desired. The plants' most critical period of water requirement was during the pod filling stage. The amount of water needed as supplemental irrigation varied with the year and location. The water usage during pod filling was 2 to 8 times more in a dry year like 1978 compared to a wet year like 1979. Stressed plants tended to close their stomata and thereby increase their leaf diffusive resistance. This reduced their sensitivity to environmental variables and evaporative demands. Nonstressed plants were much more sensitive to environmental variables such as soil water content and solar radiation.
W80-01796

NONPOINT SOURCE POLLUTION CONTROL BY SOIL AND WATER CONSERVATION PRACTICES,
Cornell Univ., Itahca, NY. Dept. of Agriculture Engineering.
For primary bibliographic entry see Field 2E.
W80-01892

STATUS OF PRESENT PEATLAND USES FOR AGRICULTURAL AND HORTICULTURAL PEAT PRODUCTION,
Minnesota Univ., Minneapolis. Dept. of Soil Science.
For primary bibliographic entry see Field 2H.
W80-01929

MOBILE PIVOT TOWER FOR IRRIGATION SYSTEM,
Rainmatic International Ltd., Honolulu, HI. (Assignee).
K. J. Hegemann.
U.S. Patent No 4,163,459, 6 p, 4 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 65, August 7, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Application equipment, Irrigation practices, Irrigation efficiency, Pivot towers.

A center pivot irrigation system comprises mobile towers spaced apart and aligned in a row with an irrigation pipe extending between them and suported on the towers. The row of a aligned towers pivots about a mobile pivot tower located at the water supply. The mobile pivot tower comprises a vertically disposed frame mounted on a pair of wheels. The frame and one wheel are mounted to pivot about the other wheel, and anchoring structure restrains the other wheel from moving during pivoting of the frame and one wheel. (Sinha-OEIS)
W80-01940

DRIP IRRIGATION APPARATUS,
W. Meckel.
U.S. Patent No. 4,166,580 4 p, 4 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 986, No 1, p 105, September 4, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation practices, Irigation efficiency, Flow control, Drip irrigation.

A drip-forming device for drip irrigation apparatus comprises a tube having a smooth internal surface and a a smooth surfaced rod having one end inserted into the tube by an adjustable amount. The rod is formed with a least one longitudinal groove which extends along its length and which is in communication with the part of the interior of the tube not occupied by the rod and whose depth decreases progressively away from the one end over at least part of the length of the groove. With such devices, the output of each device can be simply adjusted to suit the local requirements, irrespective of the size, alignment and supply pressure of the complete irrigation apparatus, by adjustment of the depth of insertion of the rod in the tube. For a constant pressure the water output decreases with increasing depth of rod insertion--i.e., as the minimum cross-section of the groove at the point of insertion of the rod in the tube decreases. At different pressure depending, for example, on gradient, the water output from different devices can be made equal by varying the depth of insertion of the rods in the tubes appropriately. (Sinha-OEIS)
W80-01974

LOCK VALVE FOR SPRINKLER,
Safe-T-Lawn, Inc., Hialeah, FL. (Assignee).
R. J. Harrison.
U.S. Patent No. 4,166,576, 4 p, 3 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 986, No 1, p 104, September 4, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, Sprinkler irrigation, Flow control, Water measurement, Flow measurement, Irrigation efficiency.

This invention relates to the field of irrigation devices which are easily connectable to a water line to allow water to be metered out of the line at a given specified rate. To use the device, the bubble is connected to an input pipe, the valve is adjusted and then the wedge shaped protuberance is broken away from the body portion at the border area. When the water is turned on it flows through the body. The water then flows between the upper surface of the cylindrical body and the bottom surface of the cover until it escapes via the nozzles in the cover. Since the body and cover are adjustably connected via a screw the distance between the two components may be adjusted and hence the flow of water can be adjusted by simply turning the cover. When the desired flow rate is achieved, the wedged shaped object previously broken off from the body is forced into the wedging cavity between the body and the cover thus locking the cover and body into a fixed position relative to one another. (Sinha - OEIS)
W80-01987

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

SLOW SAND FILTERS FOR THE LEYTE METROPOLITAN WATER DISTRICT,
Trans-Asia, Manila (Philippines).
E. S. Salvo.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani & N. C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 415-420, 1978. 2 Fig, 2 Tab, 5 Ref.

Descriptors: *Sand filters, *Metropolitan water districts, *Water supply, *The Philippines, Water demand, Water resources development, Planning, Pipes, Head loss, Hydraulics, Population forecast, Developing countries.

The Leyte Metropolitan Water District comprises the city of Tacloban and the municipalities of Palo, Tanauan, Pastrana and Dagami. The most advantageous source of water is located high up in the mountains but because of the high cost of construction to the site, a new source on the same river was selected. The new source is lower in elevation by 85 meters but substantially inhabited. An infiltration gallery utilizing the principles of slow sand filters was designed. Two layers of sand and well-graded gravel formed the filter media. Slotted po-

lyvinyl chloride pipes formed the underdrains. (Bell-Graf--Cornell)
W80-01648

LEVEL-B MULDUAL-PURPOSE DETENTION BASINS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr.
Journal of the Water Resources Planning and Management Division, Proceedings of the American society of Civil Engineers, Vol 105, No WR2, September 1979, p 403-412. 3 Fig, 32 Ref.

Descriptors: *Urbanization, *Dams, *Multiple-purpose projects, *Runoff, *Streams, *Flood control, *Water quality, Design, Detention reservoirs, Environmental effects, Land use, Regulations, Water pollution, Urban development.

Design criteria for small detention basins, which are being built in large numbers to reduce flooding in rapidly urbanizing areas, may be modified to serve additionally the purpose of reducing runoff pollution, which also accompanies urbanization. Only slight reduction in local flood-control effectiveness will be entailed by the modification, and the dual-purpose basins will be more useful in aid of flood control further downstream than the single purpose locally-oriented structures. Runoff pollution from urbanizing areas is important to water-quality planning, and occurs largely in particulate form. However, the trap effectiveness of detention basins for different kinds of pollutant, retained in storage for various periods, has not yet been determined by research or practical experience, so that design criteria for dual-purpose detention basins cannot be stated with any degree of precision. (Bell-Graf--Cornell)
W80-01679

CHICAGO WATER SYSTEM: OPPORTUNITIES AND CHALLENGES OF LAKE MICHIGAN,
Chicago Dept. of Water and Sewers, IL.
R. A. Pavia.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR2, p371-375, September 1979.

Descriptors: *Water distribution(Applied), *Water supply, *Water treatment, *Treatment facilities, *Chicago(IL), *Water shortage, Diversion, Water purification, Water services, Lake Michigan.

As regions and localities all over the world are being faced with the growing problem of water shortages, Chicago is fortunate to have Lake Michigan, an excellent source of supply that can be readily treated to a high-quality finished product. Chicago's vast water system presently serves a population of approximately 4,600,000 people in Chicago and 74 neighboring suburban communities and operates the world's two largest water purification plants. Eleven pumping stations located throughout the City pump over 374.7 billion gallons (1,423,860,000sq m) of water a year. The system comprises 4,160 miles (6,697.6km) of water mains and 65 miles (104.65km) of water supply tunnels. Water intake cribs constructed off the shores of Lake Michigan supply the purification plants with raw water for processing. (Bell-Graf--Cornell)
W80-01681

WATER SUPPLY REGIONALIZATION: A CRITICAL EVALUATION,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
R. M. Clark.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR2, p 279-294, September 1979. 3 Fig, 6 Tab, 9 Equ, 10 Ref.

Descriptors: *Water distribution(Applied), *Water supply, *Regional planning, *Potable water, *Evaluation, *Federal laws, Urban planning, Utilities, Water quality, Costs, Economic analysis, Systems engineering, Drinking water, Regional water systems, Technology, Human population, Scale effects, Water treatment, Support services.

The Safe Drinking WAter Act will cause a careful examination of the way water is handled before it is delivered to the consumer. A part of the 'Act' explicitly encourages development of regional water supplies. Federal policy makers tend to interpret regionalization as meaning a centralized system with one single large-scale plant. There is nothing inherently wrong with this approach and there is some evidence that larger supplies provide high quality water. These 'quality' and economies of scale arguments are examined and evidence is provided that there are limits to the efficient size of water supply systems. Given these limits, the issue to be considered is one of decentralized plants serving one regional authority versus independent systems. The efficiency of a regional authority might be maintained at the expense of losing individual political autonomy. (Bell-Graf--Cornell)
W80-01684

FLOOD INSURANCE PROGRAM: REGIONAL AGENCY'S PERSPECTIVE,
Donohue and Associates, Inc., Waukesha, WI.
S. G. Walesh.
Journal of the Water Resources Planning and Management Division, Proceedings of the Amrican society of Civil Engineers, Vol 105, No WR2, September 1979, p 243-257. 20 Ref.

Descriptors: *Flood control, *Urban planning, *Insurance, *Regulations, *Flood plains, Water resources, Urban development, Floods, Land use, Management, Programs, Watersheds(Basins).

While the National Flood Insurance Program (NFIP) has enhanced flood plain management on the national level, some aspects of the program have frustrated flood plain management efforts within state and local governmental jurisdiction. Positive features of the NFIP as seen from the perspective of a regional planning agency experienced in flood plain management are: mandatory flood plain regulations and certainty of post-flood financial assistance. Negative features of the NFIP are: problems associated with the required floodway delineations, the civil division orientation, use of existing condition flood hazard data for regulatory purposes, and the limited scope with respect to finding solutions to existing and future flood problems. The effectiveness of the NFIP could be enhanced by: conducting studies on a watershed basis, encouraging comprehensive land use planning and control in riverine areas, analyzing upstream and downstream impacts of floodways, determining the impact of future land uses, and encouraging the use of flood insurance studies as the first phase of comprehensive watershed studies. (Bell-Graf--Cornell)
W80-01686

WATER: A PERSPECTIVE ON GLOBAL ISSUES AND POLITICS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
A. K. Biswas.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR2, p 205-222, September 1979. 6 Tab, 9 Ref.

Descriptors: *Water management(Applied), *Water policy, *Water supply, *Industrial water, *Diseases, *Social impact, *International waters, *Water utilization, Water demand, Rural areas, Urban areas, Water balance, Environmental effects, Environmental impact statements, Agriculture, Efficiencies, Hydroelectric power generation, Political aspects.

The uneven distribution of water in the world is reviewed. Development of water quality problems is traced. The policy options for sectoral uses, especially in terms of rural and urban water supply, agriculture, industry, and hydroelectric power are outlined. The present status of water development in these four sectors is provided on a regional basis for the whole world, and in certain cases national information is also given. Lack of water development in developing countries is emphasized, and possible investment costs are indicated. Social and environmental impacts of water development projects are discussed in detail under three categories of sub-systems: physical, biological and human. It is concluded that the major problem is not one of the Malthusian specter of impending scarcity but one of instituting more rational management practices. (Bell-Graf--Cornell)
W80-01688

OPTIMAL CAPACITY OF MUNICIPAL WATER SUPPLY PUMPS,
Utah Water Research Lab., Logan.
T. C. Hughes.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR2, p 317-328, September 1979. 7 Fig, 1 Tab, 4 Ref.

Descriptors: *Water supply, *Power, *Pumping, *Rate, *Municipal engineering, *Economic analysis, *Costs, Design, Electrictiy, Planning, Economis of scale, Demand.

Capital costs of pumping equipment include economies of scale; however, such costs are now dominated by diseconomies of scale related to operating costs. The diseconomies are produced by the demand charge component of electrical power costs. A conclusion is that special emphasis should be placed upon analyzing the potential savings due to matching pump capacity as closely as practicable with peak period demands in order to increase pump use factors, thereby lowering unit pumping costs. Power cost rate schedules in current use for municipal pumping in three states are presented in dimensionless form. A sample analysis of the potential savings due to short-term planning horizons for pump capacities is presented. (Bell-Graf--Cornell)
W80-01691

THE ANALYSIS OF LARGE, COMPLEX WATER NETWORKS WITH SMALL COMPUTER SYSTEMS,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
E. R. Dodge, H. R. Hoellein, and L. Tetmajer.
Journal of the American Water Works Association, Vol 70, No 7, p 366-370, July 1978. 6 Fig, 14 Equ, 12 Ref, 1 Append.

Descriptors: *Water distribution(Applied), *Networks, *Computer programs, *Newton-Raphson approximations, Water supply, Pumps, Pipes, Equations, Systems analysis, Municipal water systems.

Computer analysis of large and complicated water distribution systems need not require correspondingly large computers if disc pack is available. A program is described herein which solves networks of up to 1000 nodes using computer memory of 35 K works and disc capability. Many engineering students are still using the Hardy Cross methods introduced over 40 years ago. Among the more promising alternatives, however, is the nodal formulation of the matrix equation using the Newton-Rhapson first-order approximations to the nonlinear equations that express rate of change of unbalanced flow at each node with respect to change of head at all connected nodes, including node under consideration. The program outlined herein, written in Fortran IV, G level language, uses this method to solve large-scale networks with supply pumps taking water from wells or reservoirs, booster pumps, pressure-actuated check valves, one-way check valves, pressure-regulating valves, reservoirs of any geometric shape, fire flows superposed on other nodal demands, and sprinkler heads at nodes for golf-course, agricultural, or building fire sprinkler applications. (Bell-Graf--Cornell)
W80-01697

BENTHOS TYPOLOGY OF SPANISH RESERVOIRS,

Barcelona Univ., (Spain). Dept. of Ecologia.
For primary bibliographic entry see Field 5C.
W80-01723

FACTORS GOVERNING TURBIDITY IN A SOUTH AFRICAN RESERVOIR,
For primary bibliographic entry see Field 5C.
W80-01724

MAN-MADE STRESS PATTERNS IN TWO IMPOUNDMENTS,
Orange Free State Univ., Bloemfontain (South Africa). Inst. of Environmental Science.
For primary bibliographic entry see Field 5C.
W80-01725

EFFECTS OF IMPOUNDMENTS ON RIVERS: AN AUSTRALIAN CASE STUDY,
Adelaide Univ., (Australia). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W80-01726

STABILITY OF DIURNAL STRATIFICATION IN THE FORMING BROKOPONDO RESERVOIR IN SURINAME, SOUTH AMERICA,
Vrije Univ., Amsterdam (Netherlands). Biological Lab.
For primary bibliographic entry see Field 5C.
W80-01727

TEMPERATURE AND OXYGEN STRATIFICATION IN AMERICANA RESERVOIR, STATE OF SAO PAULO, BRAZIL,
Sao Paulo Univ. (Brazil). Dept. of Ecology.
For primary bibliographic entry see Field 5C.
W80-01728

VERTICAL MIGRATION OF DAPHNIA GESSNERI HERBST, 1967, IN AMERICANA RESERVOIR, STATE OF SAO PAULO, BRAZIL,
Sao Paulo Univ. (Brazil). Dept. of Ecology.
For primary bibliographic entry see Field 5C.
W80-01729

IMPOUNDMENTS AND THEIR INFLUENCE ON THE RIVERS STUDIED BY BIOASSAYS,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
For primary bibliographic entry see Field 5C.
W80-01781

RELATIONSHIPS AMONG BIOLOGICAL AND PHYSIOCHEMICAL PARAMETERS IN SPANISH RESERVOIRS,
Instituto de Investigaciones Pesqueras, Barcelona (Spain).
For primary bibliographic entry see Field 5C.
W80-01782

ZOOPLANKTON CRUSTACEANS IN SPANISH RESERVOIRS,
Barcelona Univ. (Spain). Dept of Ecologia.
For primary bibliographic entry see Field 5C.
W80-01783

HISTORICAL AND ECOLOGICAL FACTORS CONCURRING IN THE DISTRIBUTION, BIOMETRY AND FERTILITY OF PLANKTONIC CRUSTACEANS IN PYRENEAN LAKES,
Barcelona Univ. (Spain). Dept. of Ecologia.
For primary bibliographic entry see Field 5C.
W80-01784

COMPOSITION AND DYNAMICS OF ZOOPLANKTON IN THE SAVA LAKE,
Institute for Biological Research, Belgrad (Yugoslavia).
For primary bibliographic entry see Field 5C.
W80-01785

SEDIMENTATION PROCESS ABOVE THE ASWAN HIGH DAM IN LAKE NASSER-NUBIA (EGYPT-SUDAN),
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
For primary bibliographic entry see Field 5C.
W80-01786

OBSERVATIONS ON PHYTOPLANKTON AND PRIMARY PRODUCTIVITY IN VOLTA LAKE, GHANA,
Nigeria Univ., Nsukka.
For primary bibliographic entry see Field 5C.
W80-01787

DIURNAL VERTICAL DISTRIBUTION OF ZOOPLANKTON DURING STRATIFICATION IN KAINJI LAKE, NIGERIA,
Kainji Lake Research Inst. New Bussa (Nigeria).
For primary bibliographic entry see Field 5C.
W80-01788

SPACE-CORRELATION FIELDS OF PAN EVAPORIMETER NETWORK,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2D.
W80-01831

4B. Groundwater Management

DESIGN AND MERIT OF A RIVER-MODEL FOR OPTIMAL USE OF AGRICULTURAL WATER,
Colordo State Univ., Fort Collins. Dept. of Civil Engineering.
H. J. Morel-Seytoux, C. J. Daly, T. Illangasekare, and A. Bazaraa.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC., p 276-288, 1979. 5 Fig, 7 Ref. USBR No 7-07-70-X0009, USDA 01CD (Agreement No 58-319R-8-134).

Descriptors: *Conjunctive use, *Model studies, *Agruculture, *Design, Aquifers, Rivers, Water utilization, Analytical techniques, Computer models, Water allocation(Policy), Irrigation, *South Platte River(CO).

A stream-aquifer model was needed to assess the impact of alternate strategies of management for maximum beneficial agricultural use of water. The design of the model was discussed in detail. The design of a model specific to a particular area of the South Platte river basin in eastern Colorado was complex. The complexity resulted from the size of the system, from the need to simulate the system both at an operational time scale (week) and at a long-term planning horizon (10 years), and from the administration of a complicated water rights structure. The model designed was successfully applied to a field problem with a number of inherent complexities arising due to the physical size, the necessity to simulate the system at short time steps for large time horizons, and an administrative system based on water rights. Some of the details discussed under the design procedures are crucial in applying numerical models to real problems. The design procedures discussed in this paper made it possible to apply the model at very moderate cost of $350 for a simulation and still maintain very high accuracies in simulating the physical behavior. (Humphreys-ISWS)
W80-01805

4C. Effects On Water Of Man's Non-Water Activities

THE QUALITY OF GROUNDWATER IN CALIFORNIA,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 5B.
W80-01734

EFFECTS OF HERBICIDES ON THE SPARTINA SALT MARSH,
Auburn Univ., AL. Dept. of Botany and Microbiology.
A. C. Edwards, and D. E. Davis.
In: Ecology of Halophytes, Reimold, R. J. and Queen W. H. (eds.), Academic Press, Inc., New York, p 531-545, 1974. 4 Fig, 3 Tab, 25 Ref.

Descriptors: *Herbicides, *Marsh plants, *Salt marshes, Wetlands, Marshes, Halophytes, Arsenicals(Pesticides), Phytotoxicity, Toxicity, Grasses, Pesticides, Pesticide residues.

The literature dealing with the use of herbicides to control Spartina is reviewed with the mode of action, effects on non-target organisms, persistence, and possible effects of these herbicides on the salt marsh being discussed. Preliminary results from experiments conducted on Sapelo Island, Georgia, on the effects of monosodium methanearsonate (MSMA) on Spartina alterniflora and Littorina irrorata are reported. MSMA effects on P32 uptake by Spartina alterniflora are also given. (Steiner-Mass)
W80-01920

4D. Watershed Protection

AGRICULTURAL MANAGEMENT PRACTICES TO EFFECT REDUCTIONS IN RUNOFF AND SEDIMENT PRODUCTION.
Mississippi State Univ., Mississippi State. Dept. of Agronomy.
F. D. Whisler, J. K. Young, M. J. M. Romkens, J. Y. Wang, and N. W. Buehring.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116486, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Mississippi State University Report, October 1979. 47 p, 10 Fig, 19 Tab, 20 Ref. OWRT B-019-MISS (1), 14-34-0001-8094.

Descriptors: *Erosion rates, *Fertilizers, *Nitrates, *Phosphates, *Potash, *Pre-emergents, *Pesticides, *Particle size, *Rainfall-runoff relationships, *Sediment control, *Simulated rainfall, *Soil aggregates, *Soil managment, *Soybeans, Agricultural chemicals, Agricultural runoff, Coarse aggregates, Fine aggregates, Crop production, Hydrographs, Infiltration, Pollution abatement, Water pollution, *Alachlor, *Sedigraphs, *Trifluralin, *Selective adsorption.

This study reports on the soil erosion rates for three commonly occurring soil management systems on bottomland in soybean production, on the nutrient composition of runoff from these systems, on herbicide losses from these systems, on the relationship between sediment particle size and herbicide concentrations and the effect of different soil management systems on sediment particle (aggregate) sizes. A rainfall simulator was used on plots with soybean management systems of disc, chisel and plant (conventional); planting in old soybean stubble (minimum tillage); and broadcast seeding into standing wheat (double cropping). Fallow plots were used to evaluate the management systems effectiveness. Rainfall was applied in the fall of 1977 after soybean harvesting and again in the spring of 1978 after soybean planting. Soil loss was reduced, in order of decreasing effectiveness, by double cropping, minimum tillage, conventional, and fallow. From sediment nutrient chemical analysis the percent of fines or clay increased as the amount of sediment lost by a particular management system decreased. Greatest nutrient losses were associated with the sediment phase of the runoff. Herbicide losses were greatest for the more water soluble herbidides. The herbicides appeared to be selectively adsorbed to either the large sediment particles (probably aggregates >2 mm) or the fine particles (probably silt and clay <0.063 mm).
W80-01607

STUDIES OF TILLAGE-INDUCED EFFECTS ON HYDRAULIC CONDUCTIVITY.
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 2G.
W80-01798

RUNOFF LOSSES OF SURFACE-APPLIED HERBICIDES AS AFFECTED BY WHEEL TRACKS AND INCORPORATION,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. L. Baker, and J. M. Laflen.
Journal of Environmental Quality, Vol 8, No 4, p 602-607, October-December 1979. 4 Fig, 5 Tab, 7 Ref.

Descriptors: *Runoff, *Herbicides, *Sediments, Suspended solids, Soil compaction, Farm management, Water pollution, Water pollution sources, Water pollution control, Pollutants, Path of pollutants, Sampling, On-site investigations, Wheel tracks, Incorporation, Best management practices, Propachlor, Atrazine, Alachlor.

The effects of incorporation and wheel-track compaction on runoff losses of herbicides were determined by measuring losses of propachlor (2-chloro-N-isopropylacetanilide), atrazine ((2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine)), and alachlor ((2-chloro-2', 6'-diethyl-N-(methoxymethyl) acetanilide)) in water and sediment from small plots during 122 mm of simulated rainfall. Losses of propachlor, atrazine, and alachlor that were surface-applied to plots without wheel tracks were 3.0, 4.7, and 8.0%, respectively. Corresponding losses from plots where the herbicides were incorporated by disking were only 0.8, 1.6, and 1.7%. Hydrologic differences (more and sooner runoff) caused by wheel tracks on plots where herbicides were surface-applied increased the corresponding losses to 12.7, 18.3, and 22.1%. Although herbicide concentrations were greater in sediment than in water for all treatments, from 82 to 89% of the losses were in solution. (Sims-ISWS)
W80-01838

SOIL CONSERVATION LIMITATIONS ON REMOVAL OF CROP RESIDUES FOR ENERGY PRODUCTION,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Lab.
For primary bibliographic entry see Field 2J.
W80-01839

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

WATER POLLUTION OF CHI-SHURI RIVER IN TAIWAN,
National Cheng Kung Univ., Tainan (Taiwan). Dept. of Environmental Engineering.
J. F. Kao, C. G. Wen, and S. S. Cheng.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergman Press Inc. in USA), p 125-132, 1978. 3 Fig, 2 Tab, 8 Equ, 5 Ref.

Descriptors: *Water pollution, *Chi-Shui River(Taiwan), *Pollution loading, *Water quality models, Biochemical oxygen demand, Dissolved oxygen, Equations, Industrial wastes, Waste water(Pollution), Pollutants, Paper mills, Estimating, Sugar plants, Systems analysis, Estuaries, Assimilative capacity.

Industrial wastes, domestic sewage and materials flushed by runoff contribute to the major pollutional load of the Chi-Shui River, located in southwest Taiwan. The critical period of pollution occurs during the dry winter season, when industrial wastes produce on average 51 metric tons of BOD/day and a domestic sewage discharge of 2 metric tons of BOD/day. However, the assimilative capacity of this river is estimated at 4.7 metric tons of BOD/day by the empirical model. Anaerobic biodegration occurs over the estuary area because very little dissolved oxygen is utilized to degrade organic pollutants. In addition, noxious residual pollutants cause harmful effects in fishing areas. A study of river pollution characteristics is a prerequisite for the development of an efficient monitoring system to enforce the water pollution control program, which will have long-term beneficial effects on aquatic ecology and fish culture. (Bell-Graf--Cornell)
W80-01621

RIVER, ESTUARY, LAKE AND RESERVOIR QUALITY MANAGEMENT,
Department of Irrigation, Colombo (Sri Lanka).
S. H. C. De Silva.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 147-153, 1978. 1 Fig, 4 Ref.

Descriptors: *Rivers, *Estuaries, *Lakes, *Reservoirs, *Water quality, *Management, *Developing countries, Monitoring, Standards, Water resources, Water utilization, Municipal wastes, Waste disposal, Industrial wastes, Water policy.

Described are water quality criteria in general use; the parameters to be monitored in water quality management of rivers, estuaries, lakes and reservoirs are defined. The difficulties faced by developing countries in implementing standards better adapted to developed countries are listed. The goal of developing countries is the achievement of a higher standard of living for their populations. The pursuance of this objective demands growth in agriculture and industry. Such growth requires the maximum utilization of a country's water resources. Re-cycling or re-using sources of water supply become imperative. Pollution control or water quality management is thus indispensable vis-a-vis the pollution explosion. (Bell-Graf--Cornell)
W80-01624

ASSESSING RIVER WATER QUALITY BY ORDER STATISTICS,
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
S. I. Ohgaki, H. Iwai, and J. I. Matsumoto.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand. February 1978. Edited by E.A.R. Ouano, B.N. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 157-162, 1978. 7 Fig, 8 Equ, 6 Ref.

Descriptors: *Assessment, *Rivers, *Water quality, *Statistical methods, Equations, Probability, Biochemical oxygen demand, Discharge(Water), Frequency distribution, Abukuma River(Japan), Caho Phya River(Thailand).

For water pollution control, the evaluation of water quality for a certain period and at a certain station in rivers is important. Data on river water quality is, however, usually small. Herein, an attempt is made to use order statistics to estimate the probability distribution of BOD in rivers, where little data exists. The lognormal probability density functions of BOD of the Abukuma River in Japan for 1967-1973 and of the Chao Phya River in Thailand for 1970 are estimated by order statistics as actual examples. (Bell-Graf--Cornell)
W80-01625

AN ESTIMATE OF POLLUTION LOADS FROM NON-POINT SOURCE OF AN URBAN CATCHMENT,
Singapore Univ. Dept. of Civil Engineering.
K. K. Chin, and K. Y. Chen.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, February 1978. Edited by E.A.R. Ouano, V.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 163-168, 1978. 5 Fig, 6 Ref.

Descriptors: *Estimating, *Pollutants, *Urban runoff, *Canals, *Non-point sources, Rainfall, Drainage, Sampling, Flow rate, Flood water, Urban catchments.

Estimates of pollutant loads due to urban runoff at Upper Bukit Timah Catchment were made. The parameters investigated include total suspended solids, BOD, COD, organic nitrogen, and total phosphate. Data show that at a discharge less than 200 x 10 cube 10 cube m/d, pollutant loads increased with increased runoff. At higher flow rates, there was a net decrease in BOD and COD. The total phosphate and organic nitrogen loads were comparatively high. This was probably due to fertilizer and detergent being carried down to the canal during rainstorms. (Bell-Graf--Cornell)
W80-01626

EUTROPHICATION: CURRENT STATE-OF-THE-ART AND PROBABLE AREAS OF INVESTIGATION,
United Nations Educational, Scientific and Cultural Organization, Bankok (Thailand).
K. F. Jalal.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lonani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc. in USA), p 169-183, 1978. 5 Fig, 8 Equ, 22 Ref.

Descriptors: *Eutrophication, *Nutrient removal, *Technology, *Design criteria, *Phosphates, *Critical concentration, *Biochemistry, Equations, Waste water(Pollution), Water quality, Flow, Dilution, Precipitation, Surface runoff, Photosynthesis, Respiration, Developing countries.

Eutrophication is the process of enriching natural waters with nutrients. A number of questions in the field are still partially or completely unanswered. These are dealt with herein: (1) Critical concentration: What is the most critical nutrient and what is its critical concentration in natural waters. What are the possible sources and their relative importance, (2) Design criteria for nutrient removal: What is the maximum permissible concentration of critical nutrient and what should be the design criteria for its removal from waste water, and (3) Technology of nutrient removal: What is the most effective way of removal of nutrient. It is physical, chemical, biological or a combination. In any given situation, what is the specific means for achieving best results. This article considers sources of phosphate and their relative importance, design criteria for phosphate removal, and the technology of phosphate removal. It is believed that in developing countries, phosphate is the most critical nutrient responsible for eutrophication. The degree of removal of phosphate from any given wastewater may vary anywhere between zero and one hundred percent depending upon: (a) available dilution; (b) background concentration of phosphate in the receiving water; and (c) critical concentration of phosphate above which algal nuisance will occur. (Bell-Graf--Cornell)
W80-01627

POLLUTION MODELLING FOR ENCLOSED WATER BODIES,
World Health Organization, Istanbul (Turkey). Environmental Research and Training.
S. J. Arceivala.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 199-209, 1978. 2 Fig, 18 Equ, 6 Ref.

Descriptors: *Water pollution control, *Mathematical models, *Data, *Nutrients, *Oxygen balance,

*Pollution balance, *Enclosed seas, *Bays, Pollutants, Simulation analysis, Hydrodynamics, Algae, Equations, Systems analysis, Waste water discharge, Prediction.

Some form of mathematical modeling is often required for predicting nutrient and oxygen concentrations in enclosed seas and bays to which waste water is proposed to be discharge. This requires an understanding of some of the major factors and processes affecting the fate of pollutants in the water body so that they can be simulated mathematically. This paper describes how a typical pollution balance model is formulated, the nature of data required, and the calibration and use of such models. (Bell-Graf--Cornell)
W80-01628

NEW APPROACH FOR PREDICTING DISSOLVED OXYGEN LEVELS OF PULLUTED STREAMS,
Singapore Univ. Dept. of Civil Engineering.
M. A. Aziz.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 211-217, 1978. 4 Fig, 7 Equ, 10 Ref.

Descriptors: *Dissolved oxygen, *Natural streams, *Water pollution, *Prediction, Simulation analysis, Mathematical models, Equations, Systems analysis, Effluents, Downstream, Sewage, Organic pollutants, Flow, Depth, Velocity, Temperature.

This paper represents an attmept to predict dissolved oxygen levels of organically polluted streams based on rates of change of major controlling parameters which have been studied in a simulated stream under varying conditions of polluton load, micro-organisms, velocity, depth of flow, and temperature. Based on these rates, a mathematical model has been developed and tested on a natural stream polluted by a single sewage effluent discharge. The model has been found successful in predicting dissolved oxygen levels at various stations downstream. (Bell-Graf--Cornell)
W80-01629

OUTLINE OF A GLOBAL WATER QUALITY MONITORING PROGRAM,
Canada Centre for Inland Waters, Burlington (Ontario).
S. Barabas.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 221-228, 1978.

Descriptors: *Water quality, *Monitoring, *Networks, *Data storage and retrieval, *Programs, *United Nations, Effluents, Analytical quality assurance, Global, Environmental control.

A United Nations-sponsored project to monitor long-term trends in water pollution of a selected number of rivers, lakes and aquifers around the world is scheduled for gradual implementation over the next three years. The purpose of monitoring is to detect any serious deterioration of the environment as a result of the introduction of manmade pollutants and to provide advance warning to mankind. The four main components in the Global Water Quality Monitoring program (GWQM) are: (1) establishment of a global network of monitoring stations at appropriate sites; (2) adoption of uniform methodologies of water sampling and analysis; (3) application of a continuing water quality assurance program; and (4) development and use of a comprehensive data storage and retrieval system. This paper describes the origin, objectives, and operational features of the United Nations-sponsored program of international significance. Discussed are: monitoring network, including operating procedures and analytical parameters; analytical quality assurance; data storage and retrieval; and validity of global monitoring. (Bell-Graf--Cornell)
W80-01630

HETEROTROPHIC UPTAKE OF 14CO SUB 2 AND WATER POLLUTION,
Prince of Songkla Univ., Haadyai (Thailand). Faculty of Natural Resources.
D. Limpadanai.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 229-232, 1978. 3 Tab, 9 Ref.

Descriptors: *Water pollution, *Heterotrophic uptake, Water bodies, Biochemical oxygen demand, Algae, Bioassay, Rivers, Wastes concentrations, Assimilation, Waste water(Pollution).

The microbial assimilation of CO2 in water bodies is a result of metabolic activity, both autotrophic and heterotrophic biosynthesis, of various groups of microorganisms. Contrary to the standard BOD determination measuring the oxygen consumption for the decomposition of organic material, the heterotrophic uptake of CO2 labelled with 14 C in wastewater was tested and the microbial decomposition of organic matter was calculated from this value. The possibilities of using this method are discussed in comparison with algal bioassay and BOD value. (Bell-Graf--Cornell)
W80-01631

LEAF BREAKDOWN AND INVERTEBRATE COLONIZATION ON A RESERVOIR BOTTOM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W80-01717

IDENTIFYING THE RUSTY MONSTERS,
Saskatchewan Univ., Regina. Water Research Inst.
D. R. Cullmore, and A. McCann.
Canadian Water Well, Vol 5, No 3, p 10-19, August, 1979. 2 Fig.

Descriptors: *Iron bacteria, *Ground water, *Water analysis, Laboratory tests, Water quality, Quality control.

Symptoms of iron bacteria in water are listed. Their occurrence is often associated with the presence of iron and manganese in the water. Iron bacteria consist of three groups: Gallinoella, Crenothrix and Sphaerotilus. These bacteria can grow in aerated ground water greater than 57 degree C with greater than 0.2 ppm iron and 0.05 ppm manganese. Initial contamination of a well with iron bacteria can occur during drilling. Various tests are presented to determine the presence or iron bacteria. The 'Iron Bacteria Presence Test' (IBPT) can detect Gallionella down to about 30 cells/m1. and is also sensitive to other bacteria. A more sensitive test is needed to evaluate the effectiveness of bacteria control measures. This test involves filtering out the bacteria, incubating them, and calculating the number of bacteria present in the original sample. This test is costly and is not routinely used. (Purdin-NWWA)
W80-01719

MONITORING LANDFILLS,
National Water Well Association, Worthington, OH.
J. Weatherington.
Water Well Journal, Vol 33, No 6, p 49-51, July, 1979. 4 Fig, 1 Tab.

Descriptors: *Landfills, *Sites, *Monitoring, Geology, Precipitation(Atmsopheric), Pollutants, Municipal wastes, Leachate, Water table, Attenuation, Zone of aeration, Ground water movement, Water pollution, Locating, Observation wells.

New regulations proposed by the EPA will control the location and monitoring of new landfills to prevent local surface and ground water contamination. Monitoring methods should be site specific based a thorough evaluation of the area's geology, hydrology, and climate. The type of refuse also has to be taken into consideration. Leachate from industrial waste will contain different contaminants than that produced by household wastes. After the initial investigation, the next step in site monitoring is to drill a series of observation wells. Depth, spacing, and number of wells will depend on the geology of the site. Sampling frequencies and duration of the monitoring program will vary from site to site. Four typical landfill situations are used to illustrate specific monitoring problems and limitations. They are (1) sand and gravel over shale; (2) clay and silt over limestone; (3) sand and silt over fractured rock; and (4) sand and gravel over a series of dipping formations. (Purdin-NWWA)
W80-01731

PETROLEUM CONTAMINATION OF WELLS,
New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 5B.
W80-01737

BIOSORPTION BY MARINE FISHES OF METHIANINE AND UREA DISSOLVED IN WATER,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
I. Z. Zubchenko.
Journal of Ichthyology, Vol 7, No 3, p 336-340, 1977. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Marine fish, *Path of pollutat, *Fish physiology, Biochemistry, Radioactivity techniques, Ureas, Radioactive carbon, Laboratory tests, Nitrogen compounds, Absorption, Biological membranes, Biological properties, Dissolved organic substances, Radioactive urea, Radioactive methianine.

A study was made to determine the permeability of the integument marine fishes to dissolved organic substances. Substances used were methianine-C14 and urea C-14 isotope analysis indicates that absorption of methianine and urea by different parts of the body differs. The caudal fin is most active in absorption. The capacity of the kinetoblast and the phagocyloblast to biosorb organic substances dissolved in water was demonstrated in the porgy and the scad. (Kate-EIS)
W80-01742

THE EFFECT OF DIMETHYL SULFATE ON THE REPRODUCTIVE SYSTEM OF THE LOACH, MISGURNUS FOSSILIS,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
A. G. Khvoles, and Yu. A. Korobko.
Journal of Ichthology, Vol 7, No 2, p 333-336, 1977. 1 Fig, 1 Tab.

Descriptors: Freshwater fish, Water pollution effects, *Path of pollutants, Bioassay, Laboratory tests, *Pulp and paper industry, *Dimethyl sulfate, Fish physiology, Animal pathology, *Reproduction, Gametogenesis, Aquiculture, Industrial wastes, Industrial water.

An investigation is made of the effect of dimethyl sulfate, a component of industrial wastes, on the reproduction of the loach, Misgurnus fossilis. The investigations indicate that in the nuclear-nucleolar cell systems substantial changes occur in the actual dimensions of the nuclei and nucleoli subjected to dimethyl sulfate and in the processes of the synthesis occurring in the cells. The authors concluded that above threshold concentrations, the process of gametogenesis in fish may be disturbed. (Kate-EIS)
W80-01743

EFFECT OF HEXACHLORANE (HCCH) ON SOME HEMATOLOGICAL AND BIOCHEMICAL CHARACTERISTICS OF THE BLOOD OF THE ROUND GOBY (GOBIUS MELANOSTOMUS),
Odessa State Univ. (USSR).
F. S. Zambriborshch, and B. Lay.
Journal of Ichthyology, Vol 7, No 3, p 507-510,

1977. 2 Tab, 15 Ref.

Descriptors: *Pesticides, *Chlorinated hydrocarbon insecticides, *Hexachlorane, Bioassay, Laboratory tests, Animal pathology, Fish physiology, Biochemistry, Marine fish, *Fish hematology, Blood sugar content, Peroxidase activity, Blood chemistry, Round guppy.

The objective was to elucidate the toxicity of low hexachlorane (HCCH) concentrations for marine fishes. The effects of HCCH on the hematological characteristics, the blood sugar content and the peroxidase activity of the round guppy was determined. In addition, at concentrations around the maximum permissible (0.012-0.024 mg/liter) hexachlorane initially increases, but subsequently decreases the number of erythrocytes and leukocytes and the amount of hemoglobin. These indicators are not restored after the fish have spent 3 days in pure water. The amount of blood sugar declines in fish poisoned with hexachlorane and does not return to normal in pure water over a period of 3 days. Peroxidase activity is the characteristic that is most sensitive to the effect of hexachlorane, and is reduced. (Katz-EIS)
W80-01745

INFLUENCES OF DIELDRIN ON THE GROWTH AND BODY COMPOSITION OF FINGERLING RAINBOW TROUT (SALMO GAIRDNERI) FED OREGON MOIST PELLETS OR TUBIFICID WORMS (TUBIFEX SP.),
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
G. R. Phillips, and D. R. Buhler.
Journal of the Fisheries Research Board of Canada, Vol 36, p 77-80, 1979. 3 Fig, 1 Tab, 25 Ref.

Descriptors: *Rainbow trout, Oligochaetes, *Chlorinated hydrocarbon pesticides, Pesticides, Insecticides, *Fish diets, Fish food organisms, Toxicity, Mortality, Bioassay, Laboratory tests, Tubificids, Aquiculture, Fish physiology, Biochemistry, *Dieldrin, Growth, Fat metabolism.

Fingerling rainbow trout (Salmo gairdneri) fed tubificid worms (Tubifex sp.) grew faster than those fed Oregon Moist Pellets (OMP) over a similar range of rations. Faster growth resulted because trout incorporated protein and fat from tubificids more efficiently than from OMP. Exposure to a sublethal concentration of dieldrin in water (0.18 microg/L) did not affect the protein elaboration of trout fed either diet or fat metabolism in trout fed OMP. However, dieldrin reduced fat elaboration in trout fed tubificids. The dieldrin concentrations in trout exposed to dieldrin in water increased as feeding level (and therefore body fat) increased. The different responses to dieldrin by fish fed these two diets provides evidence that the diet offered to fish can significantly influence the outcome of chronic toxicity tests. (Katz-EIS)
W80-01746

METHYLATED ARSENIC FROM MARINE FAUNA,
Western Australia Dept. of Fisheries and Fauna, Perth. Marine Research Labs.
J. S. Edmonds, and K. A. Francesconi.
Nature, Vol 265, p 436, 1977. 9 Ref.

Descriptors: *Arsenic compounds, Inorganic arsenic, *Methylated arsenic, Mussels, Lobsters, Marine fish, Public health, *Commercial fish, *Commercial shellfish, Chemical analysis, Australia, Western Australia, Toxicity.

Mussels, western rock lobsters, (Panulirus longipes planulatus) and stingray collected form Garden Island and Cockburn Sound, in western Australia contain dimethylated and trimethylated arsenic together with a small proportion of inorganic arsenic. It is evident that most arsenic in marine fauna is organically bound and is nontoxic. (Katz-EIS)
W80-01747

MACROBENTHIC DIVERSITY AND ORGANIC POLLUTION IN THE ARCHIPELAGO OF ALAND (N BALTIC),
Abo Akademi Turku (Finalnd). Inst. of Biology.
J. Westerberg.
Aqua Fennica, Vol 8, p 70-77, 1978. 3 Fig, 3 Tab, 9 Ref.

Descriptors: *Benthos, *Marine animals, Organic loading, *Organic wastes, Domestic wastes, Industrial wastes, On-site investigation, Water pollution effects, Aland archipelago, Baltic Sea, Organic pollution, Diversity index.

Twelve localities with a total number of 26 stations within the Aland archipelago (N Baltic) were investigated. The localities represent different degrees of exposition to water movements. Some of them are subject organic pollution being loaded by industrial and municipal wastes. A pollution index (BCI) was used to evaluate the dominance diversity index derived rrom the Shannon-Weiner function as a measure of organic pollution. The BCI was based on both qualitative characteristics and quantitative data of soft-bottom macrofauna. Diversity and organic pollution were shown to be positively correlated within restricted areas. Estimations of diversity for comparative purposes when measuring organic pollution of widely different areas showed to be meaningless. Yet diversity seemed to be correlated to organic pollution from polluted to semi-healthy bottoms, whereas very low values of diversity were obtained for the most healthy bottoms. (Katz-EIS)
W80-01748

HEAVY METAL RESIDUES IN DULSE, AN EDIBLE SEAWEED,
Fisheries and Marine Service, Halifax (Nova Scotia). Halifax Lab.
G. R. Sirota, and J. F. Uthe.
Aquaculture, Vol 18, p 41-44, 1979. 1 Fig, 3 Tab, 4 Ref.

Descriptors: *Heavy metals, *Spectroscopy, *Foods, Chemical analysis, Marine plants, Copper, *Cadium, *Lead, *Zinc, *Mercury, Water chemistry, Atlantic Ocean, Aquiculture, *Seaweed, *Dulse, *Palmaria, *Arsenic, *Selenium.

The Seaweed commonly known as dulse (Palmaria Palmata Guiry) has been consumed as a snack food and vegetable since the early nineteen-hundreds. Although it is a relatively common snack food on the eastern coast of North America, little is known about its elemental composition. Dulse from three geographically different areas and a common holding tank was analyzed for As, Cu, cd, Pb, Se, Zn and Hg by flameless atomic absorption spectroscopy. Concentration ranges (microg/g dry weight) were: As 5.50-7.50, Cu 3.90-6. 34, Cd 0.97-2.65, Pb 0.688-3.5, Se 2.00-2.91, Zn 57.5-84.1, Hg $<$ 0.02. Percent moisture was 13.50-23.45 in terms of safety as a food item, the heavy metal values for dulse reported in this paper lie well within those established for a foodstuff. (Deal-EIS)
W80-01757

THE EFFECTS OF CHLORINE, ELEVATED TEMPERATURE AND EXPOSURE DURATION OF POWER PLANT EFFLUENTS ON LARVAL WHITE PERCH MORONE AMERICANA (GMELIN),
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
L. W. Hall, Jr., D. T. Burton, and S. L. Margrey.
Water Resources Bulletin, Vol 15, No 5, p 1365-1373, 1979. 2 Fig, 1 Tab, 24 Ref.

Descriptors: *Larval growth stage, *Chlorine, *Water temperature, *Toxicity, White perch, Mortality, Lethal limit, Fish physiology, Powerplants, Thermal pollution, Cooling waters, Heated water, Heat resistance, Bioassay.

Chlorine-termperature interaction studies with various exposure times were conducted on 25-day old larval white perch. The interactions of chlorine, temperature change and exposure periods were established by regression model techniques. An initial interaction model showed that temperature change was not a factor which contributed to death. A predictive model for chlorine and exposure duration was constructed which showed that potential impact to larval white perch from chlorine at power facilities with once through cooling systems can be minimized by (1) using short duration expoures ($<$1 hour) to chlorine in plants that chlorinate intermittently or (2) by rapid mixing in the receiving stream in plants that chlorinate on low level ($<$0.05 mg/1) continuous basis. Similar considerations should be given to cooling tower blowdown which contain chlorinated water. (Deal-EIS)
W80-01759

COPPER AND NUTRITION IN HELIX POMATIA (L.),
Innsbruck Univ. (Austria). Inst. fuer Zoophysiologie.
H. Moser, and W. Wieser.
Oecoligia, Vol 42, p 241-251, 1979. 2 Fig, 6 Tab, 24 Ref.

Descriptors: *Copper, *Snails, *Adsorption, Chemical analysis, Path of pollutants, Heavy metals, Animal populations, Seasonal, Gastropods, Isopods, Animal physiology, Animal metabolism, Feeding rates, *Tissue analysis, *Bioaccumulation, *Helix.

In Helix pomatia the efficiency of assimilation of both food (lettuce) and copper is always high, even when the food has been artificially enriched with copper. In short-term feeding experiments with lettuce conaining 1390 ppm copper about 97% of the metal ingested remains in the snail. The availability of copper in the faeces is independent of the type of food and does not differ much from the availability of the metal in untreated lettuce. About half of the metal can be extracted by 0.1 MC1, whereas the half is liberated only by ashing. The concentration of copper in the organs of a natural population of H. pomatia varied between 20 and 120 ppm (dry weight). Being by far the largest organ the foot contains most of this copper. After the snails have fed on copper-enriched food for three weeks the concentration of copper increases mainly in the alimentary tract and in the midgut gland, but no one organ is capable of concentrating copper to a much higher degree than another. In winter animals which had been feeding on copper-enriched food prior to hibernation, the concentration of copper in several organs may reach values that are from 10 to 40 times higher than those in summer animals. (Deal-EIS)
W80-01760

METABOLIC RESPONSES TO TEMPERATURE CHANGE IN A TROPICAL FRESHWATER COPEPOD (MESOCYCLOPS BRASILIANUS) AND THEIR ADAPTIVE SIGNIFICANCE,
Colorado Univ., Boulder. Dept. of Environmental, Population and Organismic Biology.
R. W. Epp, and W. M. Lewis, Jr.
Oecologia, Vol 42, p 123-138, 1979. 2 Fig, 7 Tab, 68 Ref.

Descriptors: *Copepods, *Animal metabolism, *Water temperature, Seasonal, Adaptation, Growth stages, Animal behavior, Vertical migration, Tropical regions, Biorhythms, Aquatic animals, habitats, Venezuela, Lake Valencia, *Mesocyclops.

Metabolic rates of Mesocyclops brasilianus from Lake Valencia, Venezuela, were determined at several temperatures spanning the environmental range (22-28C). The oxygen consumption per unit weight of all Mesocyclops stages from Lake Valenica are higher than most but not all CO2's from temperate copepod species that have been studied. Acclimated copepodite and adult Mesocyclops show a decreasing metabolic rate with increasing temperature over the temperature range 26-28C.
W80-01761

TEMPERATURE REQUIREMENTS OF FISHES FROM EASTERN LAKE ERIE AND THE UPPER NIAGARA RIVER: A REVIEW OF THE LITERATURE,

State Univ. of New York Coll. at Buffalo. Dept. of Biology.
J. R. Spotila, K. M. Terpin, R. R. Koons, and R. L. Bonati.
Environmental Biology of Fishes, Vol 4, No 3, p 281-301, 1979. 5 Tab, 193 Ref.

Descriptors: *Water temperature, *Lake Erie, *Habitats, Thermal stress, Heat resistance, Thermal pollution, Great Lakes, Fish populations, Aquatic environment, Spawning, Fish physiology, Biological communities, Sunfishes, Trout, Heated water, Eutrophication, Carp, Catfishes, Sockeye salmon, Freshwater fish, Channel catfish, Brown trout, Sunfish, Whitefish.

Literature on the temperature requirements of fishes expected to occur in eastern Lake Erie and the upper Niagara River is reviewed. Seventy-four species of fishes are reported from Lake Erie and sixty-one from the upper Niagara River. Incipient upper lethal temperatures range from 23C for Salmo trutta to 41C for Carassius auratus and Ictalurus nebulosus. Preferred temperatures ranged from 10C for Coregonus clupeaformis to 31.1C for Lepomis macrochirus. Spawning temperatures ranged from 3.8C for C. artedii to 15.6-27.7C for Alosa pseudoharengus. Data is discussed in terms of the effects of thermal effluents on individuals of a species, structure of aquatic communities and impact on ecosystems. Synergistic effects of temperature and toxicants and disruption of spawning are potentially the most damaging direct effects of thermal effluents. Heated water may be contributing to the present rate of eutrophication in the lake and river. Increased input of thermal effluents into the eastern basin of Lake Erie will maintain a stress on the fishery and may irreversibly damage it. (Deal-EIS)
W80-01763

COMBINED EFFECTS OF TEMPERATURE AND SALINITY ON THE SURVIVAL AND GROWTH OF THE LARVAE OF PANDALUS JORDANI (DECAPODA: PANDALIDAE),
Oregon State Univ., Newport. Marine Science Center.
P. C. Rothlisberg.
Marine Biology, Vol 54, p 125-134, 1979. 7 Fig, 2 Tab, 39 Ref.

Descriptors: *Water temperature, *Salinity, *Toxicity, *Growth rates, *Shrimp, Larval growth stage, Salt tolerance, Size, Mortality length, Animal physiology, Juvenile growth stage, Commercial shellfish, *Decapods, *Pandalus,.

Suvival and growth over an environmeental range of temperature and salinities were examined in order to help assess the importance of these environmental factors in affecting the distribution, abundance and survival of larvae and provide greater understanding of factors affecting fluctuations in adult Pandalus jordani Rathbun population sizes. Larvae were shown to have a wide tolerance to salinity, especially in the early stages, but a relatively narrow tolerance to temperature. The optimal temperatures for survival, 8C to 11C, were also optimal for growth as reflected by maximal growth increments and body size. It is therefore felt that fluctuations in temperature as seen within and between successive larval seasons would have profound effects on larval survival, growth rates and size at metamorphosis to the benthic juvenile phase. (Deal-EIS)
W80-01764

FACTORS AFFECTING THE FLUX OF ARSENIC THROUGH THE MUSSEL MYTILUS GALLOPROVINCIALIS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
M. Y. Unlu, and S. W. Fowler.
Marine Biology, Vol. 51, p 209-219. 1979. 6 Fig, 4 Tab, 38 Ref.

Descriptors: *Arsenic compounds, *Path of pollutants, *Mussels, Tracers, Radiochemical analysis, Arsenic radioisotopes, Size, Animal physiology, Animal metabolism, Water temperature, Salinity, Absorption, Chemical analysis, *Mytilus, *Tissue analysis, *Bioaccumulation, *Depuration, *Arsenic.

Radiotracer experiments were designed to study the effects of certain environmental and biological factors on arsenic accumulation and elimination processes in the Mediterranean Mussel Mytilus galloprovincialis. Arsenic (as arsenate) uptake increased with increasing arsenic concentration in the water; however, the response was not prorportional, indicating that accumulation was partially suppressed at higher external arsenic concentrations. In general, approximately 80% of the 74 As taken up was associated with the soft parts, with small mussels concentrating 74 as to a greater degree than large individuals. The highest 74 As concentrations were recorded in the byssus and the digestive gland. Increased temperature enhanced both arsenic uptake and loss. Mussels in sea water at 19% S accumulated approximately three times more 74 As than those held at 38% S. Arsenic loss was much less affected by salinity, with only a tendency for greater arsenic retention noted at lower salinities. Studies carried out in the laboratory and in situ revealed that arsenic turnover was significantly more rapid in actively growing individuals living under natural conditions, Arsenic-74 loss from the in situ group was essentially buphasic, with biological half-times of approximately 3 and 32 days for the fast and slow compartments, respectively. The active secretion of arsenic in the byssal threads contributed to the total elimination of the element from the mussels. (Deal-EIS)
W80-01765

PELAGIC TAR CONCENTRATIONS IN THE GULF OF MEXICO OVER THE SOUTH TEXAS CONTINENTAL SHELF,
Texas A and M Univ., College Station. Dept. of Oceanography.
L. H. Pequegnat.
Contributions in Marine Science, Vol 22, p 31-39, 1979. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Oil pollution, *Gulf of Mexico, Baseline studies, Oil, Sampling, Monitoring, Seasonal, Path of pollutants, Organic compounds, Texas, Analytical techniques, Water pollution sources, *Tar, *Crude oil.

Dry weight of tar from 189 neuscon samples over the South Texas continental shelf ranged from 0 to 31.86 mg/sq m during a two-year (1976-77) monthly monitoring study with an overall average of 1.6 mg/sq m. This average is not inconsistent with previously reported averages for the Gulf of Mexico, which are considerably lower than tar values reported for the Mediterranean and Sargasso Seas. Inshore stations and offshore stations averaged slightly lower tar concentrations (1.24 and 1.43 mg/sq m) than the intermediate positioned stations (2.30 mg/sq m) on all transects. Monthly average tar concentrations varied, but highest values occurred in the Spring (March-April, 6.7 and 5.8 mg/sq m) and December (3.3 mg/sq m) periods. Two northern transects, one off the Port Aransas-Corpus Christi area and the other off the Port Lavaca-Port O'Connor area, averaged considerably higher tar values (1.47 and 2.32 mg/sq m) than the two more southerly transects 0.54 and 0.27 mg/sq m). (Deal-EIS)
W80-01766

ACCLIMATION RESPONSES TO SALINITY OF THREE ESTUARINE RED ALGAE FROM NEW JERSEY,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Botany.
C. Yarish, P. Edwards, and S. Casey.
Marine Biology, Vol 51, p 289-294, 1979. 4 Fig, 1 Tab, 25 Ref.

Descriptors: *Rhodophyta, *Salinity, *Photosynthesis, Salt tolerance, Sea water, Adaptation, Metabolism, Estuarine environment, Marine algae, Cytological studies, New Jersey, Estuaries, Estuarine algae.

The effects of salinity and acclimation time on the net photosynthetic responses of 3 estuarine red algae, Bostrychia radicans, Caloglossa leprieurii, and Polysiphonia subtilissima, from Great Bay Estuary, New Jersey, were investigated. The algae were cultured in a series of synthetic seawater media of 5, 15, 25 and 35 ppt S for acclimation periods of 0, 2, 4, 8, and 16 days prior to determining their photosynthetic responses. All species were euryhaline, and demonstrated photosynthesis at all the above salinities. B. radicans, which was more common towards the mouth of the estuary, had maximum photosynthetic rate at 25 ppt S, whilst C. leprieurii and P. subtilissima, which were more common towards the head of the estuary, had photosynthetic maxima between 15 and 25 ppt, and at 15 ppt, respectively. The curves relating net photosynthesis to salinity were usually similar within a species at different acclimation periods, although statistically significant differences were sometimes noted. The acclimation periods producing maximal net photosynthesis were 0, 2 and 4 days for B. radicans, and 4 days for C. leprieurii, whilst for P. subtilissima there was no significant difference in response for any acclimation period over the range of salinities studied. (Deal-EIS)
W80-01769

EVALUATION OF THE CRITICAL THERMAL MAXIMUM FOR DETERMINING THERMAL TOLERANCE OF FRESHWATER FISH,
Battelle Pacific Northwest Labs., Richland, WA.
C. D. Becker, and R. G. Genoway.
Environmental Biology of Fishes, Vol 5, No 3, p 245-256, 1979. 4 Fig, 2 Tab, 36 Ref.

Descriptors: *Water temperature, *Heat resistance, *Sockeye salmon, *Sunfishes, Toxicity, Fish physiology, Laboratory tests, Analytical techniques, Methodology, Mortality, Fish behavior, Size, Thermal stress.

Upper loss of equilibrium and death temperatures were determined by the critical thermal maximum (CTM) method for juvenile coho salmon acclimated to 5 and 15C, and for pumpkinseed sunfish acclimated to 10 and 20C. Temperatures increase rates were 1, 6, 18, 30 and 60 C/h. Analysis of variance showed significant differences due to acclimation level, temperature increase rate, and an interaction between these variables. CTM values for coho, a stenothermal fish, were lower than those for pumpkinseed, an eurythermal fish. Generally, higher acclimations and more rapid rates of temperature increase produced higher CTM values. Upward acclimation during testing was detected only for 10C acclimated pumpkinseed at a 1 c/h increase rate. Assessments were made for CTM procedural relationships from test data and the literature. A standard increase rate of 18 decrees c/h (0.3C/min) is recommended for routine CTM determinations with fish. Other recommendations are: (1) Test fish should be small, and relatively uniform in size and condition; (2) final loss of ability to return upright should be the loss of equilibrium criterion; (3) death also should be included as a criterion in CTM determinations, with the term 'lethal thermal maximum' applied for death temperature; and (4) linearity should be maintained in time-temperature distributions of the heating rate. (Deal-EIS)
W80-01775

EFFECTS OF TEMPERATURE AND SALINITY ON THE GROWTH OF THE BENTHIC DIATOM NITZSCHIAOVALIS ARNOTT (BACILLARIOPHYCEAE),
Texas A and M Univ., Galveston. Dept. of Biology.
L. K. Medlin, and W. B. Wilson.
Contributons in Marine Science, Vol 22, p 127-136, 1979. 3 Fig, 3 Tab, 36 Ref.

Descriptors: *Diatoms, *Growth rates, *Water temperature, *Salinity, Salt tolerance, Toxicity, Gulf of Mexico, Benthic flora, Systematics, Classification, Varieties, Marine algae.

Temperature and salinity tolerance of Nitzschia ovalis and the effects of combinations of these factors on its growth show that it is a eurythermal and euryhaline benthic diatom. The effect of these environmental factors on benthic microflora is seldom stuied in vitro. N. ovalis reported here for

the time from the Guld of Mexico, grew well at salinity levels from 8 to 53 o/oo and temperature levels from 12 to 36C. Maximum growth rates occurred at combinations of 28, 30, 32C, and 28, 32 o/oo salinity. The implication of these findings to natural populations of N. ovalis are discussed. (Deal-EIS)
W80-01776

TOXICITY AND BIOCONCENTRATION OF EPN AND LEPTOPHOS TO SELECTED ESTUARINE ANIMALS,
Environmental Research Lab., Guld Breeze, FL.
S. C. Schimmel, T. L. Hamaker, and J. Forester.
Contributons in Marine Science, Vol 22, p 193-203, 1979. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Toxicity, *Insecticides, Bioassay, Mortality, Life cycles, Lethal limit, Growth stages, Path of pollutants, Pesticide toxicity, Fish physiology, Absorption, Pink shrimp, Shrimp, *Leptophos, *EPN, *Bioconcentration, *Depuration, *Leiostomus, *Spot, *Pinfish, *Lagodon.

Acute (96-hr) flow-through toxicity tests, chronic (entire life-cycle) tests, and bioconcentration studies were conducted on selected estuarine animals with the insecticides, EPN, and leptophos. In the EPN acute toxicity tests, the test animals and their 96-h LC50 values were: Mysidopsis bahia, 3.44 microg/l; Penaeus duorarum, 0.29 microg/l; Cyprinodon variegatus, 188.9 microg/l; Lagodon rhomboides, 18.3 microg/l; and Leiostomus xanthrurus, 25.6 microg/l. Test animals and 96-h LC50 values for leptophos were: M. bahia, 3.16 microg/l; P. duorarum, 1.88 microg/l; and L. xanthurus, 4.06 microg/l. In separate chronic tests, M. bahia were exposed to EPN and leptophos. Significant mortality and fewer young were produced in 4.13 microg/l EPN. in the leptophos chronic test, significant mortality occurred in concentrations 3.63 microg/l and fewer young were produced in concentrations 1.77 microg/l. L. rhomboides, exposed to EPN in a 26-day uptake study, bioconcentrated the insecticide 707 X that measured in the exposure water. When L. rhomboides were held in EPN-free seawater, no EPN was detected in their tissues after eight days. L. xanthurus, exposed to leptophos for 26 days, bioconcentrated the insecticide to only 68 X the concentration in the exposure water. No leptophos residues were detectable in tissues after 4 days depuration. Our results indicate that if either insecticide contaminated an estuarine environment in concentrations 1.0 microg/l, the most profound adverse effects on crustaceans and possbily fishes would result from acute toxicity, rather than from chronic toxicity or bioconcentration of the chemicals. (Deal-EIS)
W80-01778

PETROLEUM IN DEEP BENTHIC ECOSYSTEMS OF THE GULF OF MEXICO AND CARIBBEAN SEA,
Texas A and M Univ., College Station. Dept. of Oceanography.
W. E. Pequegnat, and L. M. Jeffrey.
Contributions in Marine Science, Vol 22, p 63-75, 1979. 2 Fig, 4 Tab, 15 Ref.

Descriptors: *Oil, *Gulf of Mexico, Oil pollution, Baseline studies, Monitoring, Pollutant identification, Chemical analysis, Organic compounds, Sampling, Benthic fauna, Gas chromatography, Water pollution sources, Sulfur, Nickel, *Caribbean Sea, *Tar, *Starfish, *Vanadium.

Petroleum hydrocarbons were analyzed from 74 benthic tar samples collected between 1967 and 1973 in the Gulf of Mexico in depths ranging from 180-3843 m and from 12 stations in the Caribbean Sea in depths of 522-4557 m. Chemical analyses showed the tars to contain no volatile hydrocarbons in the range of C10 to C40, to be highly asphaltic, low in paraffins, and unusually high in sulfur, vanadium and nickel. Evidence is presented for natural petroleum seeps from several areas in the western Gulf of Mexico, including salt diapirs (Vema Knolls), and from an area of ironstone deposits in the northeastern Gulf. Specimens of the starfish, Persephonaster echinulatus, from a southwest Gulf of Mexico station were found engulfing and solubilizing tar lumps. Plant material, often of terrestrial origin, was found in 56% of the Gulf of Mexico tar stations and 100% of the Caribbean tar stations. A rich and varied bottom fauna was found associated with stations yielding large amounts of plant material and oil. (Deal-EIS)
W80-01780

SOURCE AND LEVEL OF MERCURY IN A NEW IMPOUNDMENT,
Southern Illinois Univ. at Carbondale.
For primary bibliographic entry see Field 5B.
W80-01813

HYDROCARBONS IN BENTHIC ALGAE FROM THE EASTERN GULF OF MEXICO,
Gulf Coast Research Lab., Ocean Springs, MS.
J. S. Lytle, T. F. Lytle, J. N. Gearing, and P. J. Gearing.
Marine Biology, Vol 51, p 279-288, 1979. 4 Fig, 4 Tab, 27 Ref.

Descriptors: *Oil, *Benthic flora, *Gulf of Mexico, Aromatic compounds, Organic compounds, Marine algae, Chemical analysis, Rhodophyta, Chlorophyta, Phaeophyta, Gas chromatography, Bioindicators, Monitoring, Analytical techniques, *Aliphatic compounds.

Thirty-six samples of benthic algae were collected from the continental shelf along the eastern Gulf of Mexico. The algae contain 82.8 plus or minus 143 ppm aliphatic hydrocarbons by dry weight and 11.8 plus or minus 22.7 ppm aromatic and polyolefinic hydrocarbons. The aliphatic constituents of red algae are composed almost entirely of n-C17 (70 to 95% of aliphatic weight); green algae have varying amounts of n-alkanes in the range of n-C15 to n-C19, with homologous series of odd carbon number n-alkenes. Phytadienes occur as high as 740 ppm dry weight in the green algae and do not appear to be related to time or place of collection or to presence of any petroleum pollutants. The single brown algal species contains predominantly n-C15. About 30% of the samples have hydrocarbons resembling degraded petroleum residues, but no petroleum pollution of recent origin was detected in any specimen. (Deal-EIS)
W80-01844

SAMPLING PROGRAMS FOR EVALUATING UPLAND MARSH TO IMPROVE WATER QUALITY,
Florida Univ., Belle Glade. Dept. of Agricultural Engineering.
S. F. Shih, A. C. Federico, J. F. Milleson, and M. Rosen.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 828-833, july-August 1979. 4 Fig, 6 Tab, 8 Ref.

Descriptors: *Water quality, *Marshes, *Nutrients, *Sampling, *Florida, Freshwater marshes, Nitrogen, Phosphorus, Calcium, Water chemistry, Soils, Vegetation, Flow, Effects.

Performance of upland marsh to improve water quality was evaluated using an indirect sampling program which included the water chenistry, marsh vegetation, nutrient uptake, soil profile nutrient content, and flow velocity measurement. The results indicated that the retention rates for phosphorus were about 2.0-9.8 mg/day/sq m, the release rate for nitrogen was about 0.7-3.9 mg/day/sq m, the nutrient uptake rates by vascular marsh vegetation were 0.031 and 0.007 g/day sq m for nitrogen and phosphorus, respectively; the highest concentrations for nitrogen, phosphorus, and calcium were in the top 15 cm layer of the soil; and the flow velocity in the marsh ranged from 1.2 to 2.8 cm/s during the middle of wet season. (Sims-ISWS)
W80-01852

KALMAN FILTER MODELING OF THE SPEED RIVER QUALITY,
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
For primary bibliographic entry see Field 5B.
W80-01860

MATHEMATICAL MODELING OF DISSOLVED OXYGEN IN MIXED ESTUARIES,
Department of Local Government, Brisbane (Australia).
For primary bibliographic entry see Field 5B.
W80-01861

A MODEL FOR NITRATE-NITROGEN TRANSPORT AND DENTRIFICATION IN THE RIVER THAMES,
Thames Water Authority, Reading (England), Thames Conservancy Div.
For primary bibliographic entry see Field 5B.
W80-01863

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5B.
W80-01865

SUSPENDED SEDIMENT-PHOSPHORUS RELATIONSHIPS FOR THE INFLOW AND OUTFLOW OF A FLOOD DETENTION RESERVOIR,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W80-01872

SEDIMENT HYDROCARBONS NEAR AN OIL RIG,
Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry.
For primary bibliographic entry see Field 5B.
W80-01885

WINTERTIME RAW-WATER CONTAMINATION AT CHICAGO'S SOUTH WATER FILTRATION PLANT,
Argonne National Lab., IL.
For primary bibliographic entry see Field 5B.
W80-01886

THE EFFECT OF NICKEL ON THE GROWTH OF THE FRESHWATER DIATOM NAVICULA PELLICULOSA,
Notre Dame Univ., IN. Dept. of Biology.
J. S. Fezy, D. F. Spencer, and R. W. Greene.
Environmental Pollution, Vol 13, p 131-137, 1979. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Nickel, *Toxicity, *Growth rates, *Diatoms, Cytological studies, Heaby metals, Aquatic populations, Aquatic algae, Inhibition, Mode of action, Water chemistry, Bioassay, Laboratory tests, *Navicula.

The effect of nickel on the growth of the freshwater diatom Navicula pelliculosa was determined by noting differences in the growth rate and number of cells present in laboratory cultures exposed to 0, 100, 300 and 600 microg/litre nickle for 14 days. Nickel concentrations as low as 100 microg/litre reduced the population growth rate by 50% and led to decreased 14-day cell numbers. Calculation of the equilibrium composition of the culture medium showed that 99.8% of the total nickel added existed as Ni+2. The occurrence of Ni+2 in the medium was associated with reduced algal growth. (Deal-EIS)
W80-01897

THE EFFECTS OF TOLUENE ON EMBRYOS AND FRY OF THE JAPANESE MEDAKA ORYZIAS LATIPES WITH A PROPOSAL FOR RAPID DETERMINATION OF MAXIMUM ACCEPTABLE TOXICANT CONCENTRATION,
State Univ. of New York Coll. at Brockpost. Dept. of Biological Sciences.

F. W. Stoss, and T. A. Haines.
Environmental Pollution, Vol 13, p 139-148, 1979. 4 Fig, 1 Tab, 19 Ref.

Descriptors: *Growth stages, *Toxicity, *Bioassay, Fry, Fish eggs, Embryonic growth stage, Fish physiology, Mode of action, Methodology, Organic compounds, Oil, Mortality, *Toluene, *Teratogens, *Mutagens, *Medaka, *Oryzias.

Fertilised eggs at various stages of development and newly hatched fry of medaka were exposed to a series of concentrations of the water-soluble extract of toluene. Static bioassays were conducted and TL50 calculations made. In addition, the embryos were examined for the presence of developmental anomalies. The mean 96 f TL50 for eggs was 54 mg/litre. The early (<3.5h) and late (>192h) stages were more sensitive than the average. The newly hatched fry were not as sensitive to toluene as were the embryos. In addition to acute toxicity effects, concentrations of toluene as low as 41 mg/litre produced teratogenic effects in susceptible embryos. We propose that the observation of these defects in the transparent eggs constitutes a simple and rapid tool for the estimation of Maximum Acceptable Toxicant Concentration (MATC) for fish. (Deal-EIS)
W80-01922

MONITORING AREAWIDE RURAL WATER QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
L. F. Bliven, F. J. Humenik, F. A. Koehler, and M. R. Overcash.
Journal of the Environmental Engineering Division of the American Society of Civil Engineering, Vol 105, No 1, P 101-112 February 1979, 1 Fig, 4 Tab, 10 Ref.

Descriptors: *Sampling, *Water quality, *Chowan River basin(NC, VA), On-site data collections, Estimating, Statistical methods, Baseline studies, Automated sampling, North Carolina, Grab sampling, Monitoring, Virginia.

As an alternative to expensive complete and continuous methods of monitoring areawide water pollution from nonpoint sources, statistical sampling methods are proposed which can de used to account for both spatial and temporal variations in water quality parameters. Grab sampling and automated sampling are two common methods of assessing stream water quality which can be used in a statistically designed sampling program. To illustrate sampling plans which mimimize bias and imprecision from sampling methodology, point-in-time comparisons of manually depth-integrated and fixed-point automated samples were conducted for COD, TOC, TP, TKN, N03N, and CL in various rural portions of the Chowan River basin in North Carolina and Virginia. Results of these studies show that: (1) A flush-sample cycle rather than a sample-flush cycle should be employed with automated sampling, so that material which may have settled or grown in the sample intake can be expelled before a sample is obtained. (2) Chemical preservation should be considered when refrigeration of samples is not feasible. (3) If acid fixation is employed, field storage time should be as short possible to minimize chemical oxidation of the organics which can be reducing TOC and COD concentrations. (4) Use of daily weather predictions as a means of time stratification could be tried to improve water yield estimate precision at a given-grab-sampling intensity. (Harris-Wisconsin)
W80-01976

AUTOMATIC WATER/SEWER SAMPLER,
C. Farnworth.
U.S. Patent No. 4,166,392, 8 p, 4 fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 986, No 1, p 41, September 4, 1979.

Descriptors: *Patents, *Sampling, *Water sampling, On-site data collections, Automation, Sewers, Dye releases.

An automatic water/sewer sampler, is a totally immersible, rechargeable battery powered, and is of rustproof stainless and aluminum construction. It is constructed so that it may be suspended under water at a raw water inlet or from a ladder rung to hand in a sanitary sewer flow. The bottom fill feature permits taking a sample in a flow level of six inches or less. It is not affected by atmospheric pressure. The samples are collected in vacuum flasks, surrounded by insulation material to protect the biological and temperature conditions of the sample until the device is returned to the laboratory for analysis. When installed in the field, the device will take a (500) milliliter sample each hour for eight hours, and the knife edge sample flask gate valve will open to accept up to half inch lumps of particulate matter and still shear through to seat and seal. The sampler also features a 'reverse cycle; in which the device may be filled with liquid chemicals or trace dyes in the laboratory to be time released at the field site. (Sinha-OEIS)
W80-01992

5B. Sources Of Pollution

NITROGEN MOVEMENT TO LAGUNA LAKE THROUGH DRAINAGE FROM RICE FIELDS,
International Rice Research Inst., Los Banos, Laguna (Philippines).
V. P. Singh, T. H. Wickham, and I. T. Corpuz.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 141-145, 1978. 3 Tab, 9 Ref.

Descriptors: *Nitrogen, *Water movement, *Nutrient losses, *Drainage, *Laguna Lake, Surface waters, Water treatment, Management, Runoff, Fertilizer, Irrigation, Water supply, Crops, Flow.

Nitrogen losses through surface drainage showed considerable variation by site, treatment and time. All treatments in both seasons lost less N (1.1 kg/ha per crop) with incorporated N than with top-dressed N (2.9 kg/ha per crop). The difference was greatest where water was supplied continuously. Treatments with incorporated N and infiltration water management had the least losses; in fact, there was a net gain of 1.8 kg/ha per crop for these treatments. Among the water management treatments, continuous flow resulted in maximum loss (5.5 kg/ha per crop), while the infiltration treatments resulted in a net gain of 1.5 kg/ha per crop. (Bell-Graf--Cornell)
W80-01623

A SIMPLIFIED STREAM MODEL OF ACID MINE DRAINAGE EFFECTS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
R. A. Chadderton.
Water Resources Bulletin, Vol 15, No 4, p 1159-1167, August 1979. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Acid mine water, *Mathematical models, *River systems, *Acid streams, *Acid-base equilibrium, Rivers, Water quality, Alkalinity, Travel time, Carbon dioxide, Reaeration, Mixing, Model studies.

Three methods of modeling acid mine drainage effects were discussed. A net alkalinity routing model was the simplest of these, but it can be potentially misleading. It typically overestimates the effect of acid sources on pH by neglecting carbon dioxide transfer to the atmosphere. Inclusion of a simple carbon dioxide transfer function can substantially reduce errors in stream quality prediction. A plug flow reaeration equation, coupled with mass balancing at mixing points in a stream network, provides modeling results comparable to those of more complex computerized solutions of chemical equilibrium equations. None of the models accounts for carbonate dissolution or oxidation and hydrolysis of ferrour iron. (Adams-ISWS)
W80-01652

MONITORING CHANGES IN GROUND WATER QUALITY,
H. LeGrand.
Water Well Journal, Vol 33, No 6, p 53-56, July, 1979. 2 Fig.

Descriptors: *Ground water, *Water quality, *Monitoring, Observation wells, Tracers, Locating, Depth, Ground water movement, Pollutants, Migration, Attenuation, Planning, Model studies, Hydrogeology, Economics, Path of pollutants.

Ground water of acceptable quality is commonly in contact with water of inferior quality. Simple and economic methods of determining precisely the boundary zones between contaminated and uncontaminated water are not available. As a result, much reliance is placed on monitoring wells. Planning a monitoring program should be based on a preliminary evaluation of the hydrogeologic framework, mobility of particular contaminants, and man-made events causing movement of contaminated water. On this basis, proper location and depth of monitoring wells can be established. Tracers have limited value in determining the rate and direction of ground water and contaminant movement due to variations in hydrogeologic conditions along the path of movement. The need for monitoring will increase, but through technological improvements, monitoring can be minimized. One such improvement is a synthetic hydrogeologic model which can simulate the behavior of the contaminated water. Such a model, by using easily obtained data, will help to assess the need for monitoring and to conduct a monitoring program with optimum results where it is necessary. (Purdin-NWWA)
W80-01700

THE QUALITY OF GROUNDWATER IN CALIFORNIA,
California State Dept. of Water Resources, Sacramento.
J. M. Morris, Jr.
Pacific Groundwater Digest, Vol 2, No 9, p 7-13, September, 1979. 1 Fig.

Descriptors: *California, *Ground water basins, *Water quality, Geology, Climates, Urbanization, Saline water intrusion, Sewage disposal, Feed lots, Return flow.

Ground water quality in California's twelve hydrologic basins is described in terms of geologic, climatic, and manmade conditions. Major problems are high salinity due to arid climate, irrigation return flows, and seawater intrusion resulting from overdrafting, high nitrate levels due to urban and agricultural wastes, and high concentrations of specific minerals such as boron, sulfate, and arsenic due to local geologic conditions. (Purdin-NWWA)
W80-01734

PETROLEUM CONTAMINATION OF WELLS,
New York State Dept. of Health, Albany.
D. P. Ferguson.
Ground Water Age, Vol 14, No 1, p 67-74, September, 1979.

Descriptors: *Water wells, *Water pollution, *Oil, Gasoline, Storage tanks, Leakage, Location, Gas chromatography, Dyes, Tracers, Path of pollutants, Ground water movement, Drilling, Microbial degradation.

Petroleum products are persistent and highly mobile contaminants which are difficult to remove from ground water. Leakage from buried fuel tanks is the most common source of petroleum contamination of ground water. The exact location of abandoned tanks may not be known or more than one tank may be suspected. A hydrostatic test can be performed to determine if a particular tank is leaking. Gas chromatography is then used to identify the fuel in the ground water as the same as that in the leaking tank. However, this method may not be valid if the fuel changes consistency as it migrates through the soil or if a mixture of different brands of fuel is stored in the tank. Other methods are the use of dye tracers and contouring water table elevations to determine the direction of

ground water movement. Once contamination has occurred, the well owner has the options of using an activated charcoal filter to clean up the water, drilling the well deeper, or drilling a completely new well as far as possible from the source of contamination. an expensive method of removing petroleum involves microbial degradation. Several suggestions are offered to prevent petroleum contamination of wells. (Purdin-NWWA)
W80-01737

BIOSORPTION BY MARINE FISHES OF METHIANINE AND UREA DISSOLVED IN WATER,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
For primary bibliographic entry see Field 5A.
W80-01742

THE EFFECT OF DIMETHYL SULFATE ON THE REPRODUCTIVE SYSTEM OF THE LOACH, MISGURNUS FOSSILIS,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
For primary bibliographic entry see Field 5A.
W80-01743

EFFECT OF HEXACHLORANE (HCCH) ON SOME HEMATOLOGICAL AND BIOCHEMICAL CHARACTERISTICS OF THE BLOOD OF THE ROUND GOBY (GOBIUS MELANOSTOMUS),
Odessa State Univ. (USSR).
For primary bibliographic entry see Field 5A.
W80-01745

INFLUENCES OF DIELDRIN ON THE GROWTH AND BODY COMPOSITION OF FINGERLING RAINBOW TROUT (SALMO GAIRDNERI) FED OREGON MOIST PELLETS OR TUBIFICID WORMS (TUBIFEX SP.),
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5A.
W80-01746

METHYLATED ARSENIC FROM MARINE FAUNA,
Western Australia Dept. of Fisheries and Fauna, Perth. Marine Research Labs.
For primary bibliographic entry see Field 5A.
W80-01747

COPPER AND NUTRITION IN HELIX POMATIA (L.),
Innsbruck Univ. (Austria). Inst. fuer Zoophysiologie.
For primary bibliographic entry see Field 5A.
W80-01760

FACTORS AFFECTING THE FLUX OF ARSENIC THROUGH THE MUSSEL MYTILUS GALLOPROVINCIALIS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W80-01765

PELAGIC TAR CONCENTRATIONS IN THE GULF OF MEXICO OVER THE SOUTH TEXAS CONTINENTAL SHELF,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W80-01766

TOXICITY AND BIOCONCENTRATION OF EPN AND LEPTOPHOS TO SELECTED ESTUARINE ANIMALS,
Environmental Research Lab., Guld Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-01778

PETROLEUM IN DEEP BENTHIC ECOSYSTEMS OF THE GULF OF MEXICO AND CARIBBEAN SEA,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W80-01780

THE INFLUENCE OF DENSITY DIFFERENCES ON THE DISPERSION PROCESS IN SATURATED POROUS MEDIA,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2F.
W80-01810

SOURCE AND LEVEL OF MERCURY IN A NEW IMPOUNDMENT,
Southern Illinois Univ. at Carbondale.
J. F. Meister, J. DiNunzio, and J. A. Cox.
American Water Works Association Journal, Vol 71, No 10, p 574-576, October 1979. 1 Fig, 3 Tab, 17 Ref.

Descriptors: *Water pollution sources, *Lakes, *Mercury, *Fish, *Illinois, Sampling, Chemical analysis, Pollutants, Path of pollutants, Soils, Water quality, Water pollution, Reservoirs, Impoundments, Water supply, *Cedar Lake(IL).

The souce of mercury in fish in a new impoundment was identified in this study as the inundated soil. The mercury in the soil was introduced into the food chain by direct uptake by microorganisms, rather than by a dissolution process; thus, the mercury level in fish is not indicative of the quality of the impoundment as a public water supply. Moreover, an elevated mercury level in predatory fish in a new impoundment was found to be a predictable event. Because the soil, which now constitutes the lake bottom, was nearly depleted of mercury after only three years, the impoundment will be useful as a long-term recreational fishery as well as a public water supply. (Sims-ISWS)
W80-01813

DISPERSION IN STRATIFIED POROUS MEDIA: ANALYTICAL SOLUTIONS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W80-01824

ANALYTICAL NOTE--FLUORESCEIN TRACER TECHNIQUE FOR DETECTION OF GROUNDWATER CONTAMINATION,
Bender Hygienic Lab., Albany, NY.
S. Reznek, W. Hayden, and M. Lee.
Journal of the American Water Works Association, Vol 71, No 10, p 586-587, October 1979. 2 Tab, 2 Ref.

Descriptors: *Water pollution, *Groundwater, *Fluorescent dye, *Fluorescence, *Tracers, Analytical techniques, Methodology, Water pollution, Seepage, *Fluorescein.

Fluorescein is used to trace suspected seepage from a contaminated groundwater source. A detectable amount of fluorescein is added to the suspect source and then is monitored at a designated test point. Since the fluorescein can be lost by absorption or ion exchange in transit to the sampling point, the detection procedure must be as sensitive as possible. Described was a detection procedure to measure fluorescein by fluorometry as possible. Described was a detection procedure to measure fluorescein by fluorometry which is useful in tracing suspected seepage from a contaminated groundwater source. (Visocky-ISWS)
W80-01835

RUNOFF LOSSES OF SURFACE-APPLIED HERBICIDES AS AFFECTED BY WHEEL TRACKS AND INCORPORATION,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W80-01838

HYDROCARBONS IN BENTHIC ALGAE FROM THE EASTERN GULF OF MEXICO,
Gulf Coast Research Lab., Ocean Springs, MS.
For primary bibliographic entry see Field 5A.
W80-01844

TIDAL CURRENTS MEASURED NEAR A BRITISH COASTAL POWER STATION,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 2L.
W80-01850

SAMPLING PROGRAMS FOR EVALUATING UPLAND MARSH TO IMPROVE WATER QUALITY,
Florida Univ., Belle Glade. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W80-01852

NUTRIENT MOVEMENT IN STREAMFLOW FROM AGRICULTURAL WATERSHEDS IN THE GEORGIA COASTAL PLAIN,
Science and Education Administration, Tifton, GA.
L. E. Asmussen, J. M. Sheridan, and C. V. Booram, Jr.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 809-815, 821, July-August 1979. 8 Fig, 6 Tab, 19 Ref.

Descriptors: *Nutrients, *Agricultural runoff, *Streamflow, *Georgia, Sampling, Surveys, Runoff, Water pollution, Pollutants, Path of pollutants, Watersheds(Basins), Water quality, Nitrogen compounds, Nitrites, Nitrates, Chlorides, Phosphorus, Phosphorus compounds, Precipitation(Atmospheric), Chemistry of precipitation, *Little River Watershed(GA).

Chemical load of nitrate-plus nitrate-nitrogen and orthophosphate-phosphorus in runoff from a complex cover agricultural watershed in the Georgia Coastal Plain was found to be less than the rainfall input of these chemicals. Chloride load in runoff exceeded chloride load in rainfall. Measured streamflow nutrient losses showed a rage in nitrate-plus nitrate-nitrogen load from 0.14 to 0.24 kg/ha/yr and a range in the orthophosphate-phosphorus load from 0.141 to 0.144 kg/ha/yr. (Sims-ISWS)
W80-01854

SIZING COMPONENTS ON OPEN FEEDLOT RUNOFF-CONTROL SYSTEMS,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W80-01855

ANALYTICAL PREDICTION OF NATURAL TEMPERATURES IN RIVERS,
Wyoming Univ., Laramie. Dept. of Mineral Engineering.
R. D. Noble.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Technical Note, p 1014-1018, October 1979. 11 Ref, 2 Append.

Descriptors: *Water temperature, *Rivers, *Forecasting, *Mathematical models, Natural streams, Model studies, Mathematics, Analytical techniques, Theoretical analysis, Water quality.

The objectives of this paper were: An analytical solution to the prediction of the natural temperature regime of a river. This solution includes transient, convective, and despersive effects, In many instances, dispersive effects are negligible. A simplified analytical solution was also presented for this case. The groundwater temperature of the water entering the headwaters was used as a

boundary condition at the upstream end. The natural temperature regime of a river was defined as the temperature regime in the absence of any man-made alterations. The alterations can come about from channelization, impoundments, forest cover removal, irrigation, and industrial discharges. Knowledge of the natural temperature regime can be of great value when dealing with any man-made alteration so as to determine the effect of the alteration on the ecology of the river. A theoretical mathematical model was presented which can predict the axial temperature profile of an entire river basin given the meteorological and flow conditions present. The only simplification is a linearization of the heat source term. A simplified model also was presented which can be used when axial dispersion is negligible. Both models use the temperature of the groundwater in the headwaters region as a boundary condition at the upstream end. (Humphreys-ISWS)
W80-01856

ANALYZING ENVIRONMENTAL TIME SERIES,
Waterloo Univ. (Ontario). Dept. of Systems Design.
F. D'Astous, and K. W. Hipel.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Proceedings Paper 14881, p 979-992, October 1979. 3 Fig, 6 Tab, 19 Ref, 2 Append.

Descriptors: *Time series analysis, *Water quality, *Model studies, Mathematical models, Stochastic processes, Data processing, Phosphorus, Pollutants, Flow, Rivers, Water pollution, Intervening models, Missing data.

Intervention analysis was utilized to determine the effectiveness of sewage treatment for reducing phosphorus levels in rivers. Because problems involving missing data were encountered, a data interpolating technique was devised using intervention analysis. Practical examples were given to illustrate the usefulness of this method as well as the advantages of employing intervention analysis for analyzing water quality data. (Sims-ISWS)
W80-01859

KALMAN FILTER MODELING OF THE SPEED RIVER QUALITY,
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
T. W. Constable, and E. A. McBean.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Proceedings Paper 14894, p 961-978, October 1979. 5 Fig, 2 Tab, 22 Ref, 1 Append.

Descriptors: *Water quality, *Water pollution, *Model studies, *Analytical techniques, Mathematical models, Filters, Sampling, Surveys, Estimating, Estimating equations, Rivers, Pollutants, Dissolved oxygen, Biochemical oxygen deand, Nutrients, Environmental engineering, Kalman filter.

The extended Kalman filter was applied to the results of two sampling surveys conducted on the Speed River, Ontario. Magnitudes of carbonaceous and nitrogenous BOD components for these surveys were determined. Parameter magnitudes were estimated using Rosenbrock's parameter estimation technique, and the measurement error of covariance matrix for each measurement vector was established. Filtered estimates of carbonaceous oxygen demand, nitrogenous oxygen demand, the dissolved oxygen deficit concentrations were obtained. In addition, the carbonaceous and nitrogenous BOD reaction rates, the carbonaveous BOD sedimentation rate, and the maximum daily rate of photosynthetic exygen production were estimated. The utility of the extended Kalman filter to use all available information coming from both the system model of the stream processes and measurements of the state variables to provide approximate minimum variance estimates of the state and confidence limits of these estimates was shown. (Sims-ISWS)
W80-01860

MATHEMATICAL MODELING OF DISSOLVED OXYGEN IN MIXED ESTUARIES,
Department of Local Government, Brisbane (Australia).
Y. F. Ozturk.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Proceedings Paper 14923, p 883-904, October 1979. 6 Fig, 3 Tab, 23 Ref, 1 Append.

Descriptors: *Dissolved oxygen, *Biochemical oxygen demand, *Model studies, *Mathematical models, *Australia, Rivers, Estuaries, Tidal waters, Nitrogen compounds, Nitrification, Ammonia, Nitrates, Reaeration, Water quality, *Brisbane Estuary(Australia).

One of the basic difficulties in modelling DO in a given estuary is the uncertainties involved in the BOD and reaeration rates. The oxidation of both carbonaceous and nitrogenous substances simultaneously and their representation by first-order kinetics may be justified in estuaries. The carbonaceous and nitrogenous BOD rate coefficients were determined from the standard BOD tests of estuary water samples by considering the two stages of BOD separately and by adjusting the time origin of nitrification stage. The available reaeration rate coefficient equations developed for nontidal systems and applied in modeling DO in tidal estuaries did not fully represent the tidal estuaries. A new reaeration rate coefficient equation was developed for tidal systems. The proposed equation was related to the dispersion coefficient and was a function of flow depth and four-thirds power of tidal velocity. (Sims-ISWS)
W80-01861

CALCULATING OVERFLOWS FROM COMBINED SEWER SYSTEMS,
Black and Veatch, Kansas City, MO.
For primary bibliographic entry see Field 5D.
W80-01862

A MODEL FOR NITRATE-NITROGEN TRANSPORT AND DENTRIFICATION IN THE RIVER THAMES,
Thames Water Authority, Reading (England), Thames Conservancy Div.
G. D. Thomson.
Water Research, Vol 13, No 9, p 855-863, 1979. 13 Fig, 3 Ref.

Descriptors: *Nitrates, *Rivers, *Model studies, Mathematical models, Nutrients, Nitrogen, Nitrogen compounds, Denitrification, Water pollution, Water pollution sources, Pollutants, Path of pollutants, On-site investigations, Data collections, Sampling, Water quality, *Thames River(England), *England.

A mathematical model describing the mass flow, including denitrification, of nitrate in the main river Thames has been developed. A three year period, including severe drought and flooding, was used to test the model. Good agreement was found between the nitrate concentrations observed at several sites on the river Thames and those calculated by the model. The model may be used to establish the sensitivity of nitrate levels in the Thames above intakes to changes in tributary inputs which could be affected by various management strategies. (Sims-ISWS)
W80-01863

PREVALENCE OF OILED PLUMAGE OF TERNS AND SKIMMERS ON WESTERN LONG ISLAND, NEW YORK: BASELINE DATA PRIOR TO PETROLEUM EXPLORATION,
Columbia Univ., New York. School of Public Health and Administration.
M. Gochfeld.
Environmental Pollution, Vol 13, p 123-130, 1979. 3 Tab, 24 Ref, Append.

Descriptors: *Baseline studies, *Oil pollution, *Water birds, Atlantic Ocean, New York, Oil, Water pollution effects, Oil spills, Offshore platforms, Ducks(Wild), Gulls, Oiled plumage, Petroleum exploration, *Terns.

Observations at Long Island seabird colonies during the period 1969 to 1978 revealed a more or less constant prevalence of oiling of less than 1% for adult common terns and nearly 2% for adult black skimmers. Oiling was usually light (12 on a scale of 5) and very few heavily oiled birds were seen either at the colonies or elswhere on Long Island's beaches. Currently oiling of seabirds on the Atlantic Coast of North America is not a widespread or serious problem compared with its prevalence on parts of the Pacific and Gulf Coasts of North America and in Europe. Data presented here provide a baseline for comparison with future years, since oil exploration began off Long Island during 1978 and large-scale exploitation is planned. (Deal-EIS)
W80-01864

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
F. L. Petrilli, G. P. De Renzi, R. P. Morelli, and S. De Flora.
Water Research, Vol 18, No 9, p 895-904, 1979. 2 Fig, 4 Tab, 20 Ref.

Descriptors: *Water pollution, *Industrial wastes, *Sewage, *Surveys, Monitoring, Pollutants, Path of pollutants, Water pollution sources, Aerial photography, Sampling, Chemicals, Bacteria, Pathogenic bacteria, Viruses, Coliforms, E. coli, Streptococcus, Sediments, Microbiology, *Tyrrhenian Sea.

Investigations were carried out in a coastal area of the Tyrrhenian Sea, which receives wastes from a chemical manufacturing industry. Industrial wastes are conmbined with domestic sewage prior to discharge into the sea. Warm and alkaline wastewaters carry large amounts of whitish suspended solids, mainly composed of calcium carbonate, calcium sulphate, and magnesium hydroxide, which are responsible for an evident visual pollution of the sandy shore and of the facing seawater body. Alterations of physical parameters (temperature and pH values) were found to affect the investigated coastal area only to a limited extent. Conversely, aerial photographic investigations afforded a more complete picture of pollution spreading. Infrared and chiefly water-penetration images provided information on the underwater environment, and the resulting findings could be correlated with the particle size analysis of sediment samples. Fecal streptococci represented a considerable proportion of total heterotrophic bacteria in waste and seawater, whereas concentration of total and fecal coliforms was relatively low. These figures suggested a possible selective inactivation of bacteria in industrial waters, which was supported by the findings of survival tests with three bacterial species (E. coli, Strep. faecalis, and S. typhi). Survival of a virus (type 1 polio-virus) and of a virus antigen (hepatitis B surface antigen or HBsAg) was also investigated under various conditions. (Sims-ISWS)
W80-01865

DIFFERENTIAL TRACING OF OILY WASTE AND THE ASSOCIATED WATER MASS BY TAGGING WITH RARE EARTHS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
D. L. McCown.
Water Research, Vol 13, No 11, p 1065-1076, 1979. 8 Fig, 3 Tab, 14 Ref.

Descriptors: *Path of pollutants, *Oil wastes, *Tracers, *Lake Michigan, Effluents, Water pollution sources, Water pollution, Tracking techniques, Oil spills, Currents(Water), Pollutants, Sampling, Mixing, Dispersion, Water quality, Harbors, Industrial wastes, Rare earths.

A method was developed for tagging oily waste with dysprosium and the associated freshwater with samarium. Neutron activation analysis permitted determination of rare earth concentrations as low as 40 ng/l in 15-ml water samples. Shipboard sampling procedures were developed that allowed measurement of the three-eimensional distribution

of the spreading wastes and associated water. The method was applied in two field experiments that involved tracing oily wastes and polluted water from the Indiana Harbor Canal (IHC) into Lake Michigan. For a summer, floating-plume experiment, about 1400 shipboard samples were collected. Employment of the dual-tracer technique led to the following results: (1) after artificial mixing into the water column by a passing ship, the tagged oil did not immediately resurface; and (2) there were no distinguishable differences between the movement of the oil andwater over 4 km of travel. During a winter, sinking-plume experiment, 1200 lake-water samples were collected from a boat and from the raw-water intakes of Chicago's South Water Filtration Plant (SWFP). These data provided positive evidence of the intake of IHC effluent and oily waste at the SWFP. The different tracers for the oily waste and underlying water gave evidence of separate pathways to the SWFP, reflecting differing transport modes for surface and near-bottom waters. (Sims-ISWS)
W80-01866

SUSPENDED SEDIMENT-PHOSPHORUS RELATIONSHIPS FOR THE INFLOW AND OUTFLOW OF A FLOOD DETENTION RESERVOIR,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
J. D. Schreiber, and D. L. Rausch.
Journal of Environmental Quality, Vol 8, No 4, p 510-514, October-December 1979. 3 Fig, 5 Tab, 15 Ref.

Descriptors: *Sediments, *Suspended solids, *Phosphorus, *Reservoirs, Runoff, Agricultural runoff, Erosion, Watersheds(Basins), Flood control, Nutrients, Inflow, Discharge(Water), Water chemistry, Sampling, Data processing, Pollutants, Path of pollutants, Water pollution, Water quality.

Callahan Reservoir, located in an agricultural area near Columbia, Missouri, was studied for 3 years to determine the inflow and outflow suspended sediment phosphorus (P) and the solution P relationships. During the study, the mean inflow solution ortho-P concentration was 0.085 mg/liter as compared with 0.041 mg/liter for the outflow. Concentrations of ortho-P were highest in both the inflow and outflow during the fall and winter. As yearly suspended sediment concentrations decreased in both the inflow and outflow, due to lower runoff and sediment yields, solution ortho-P, as well as sediment total, inorganic, organic, and exchangeable P concentrations, increased. Similarly, as a result of coarse sediment deposition within the reservoir during individual storm events, outflow sediments were enriched in clay and had higher concentrations of total, inorganic, organic, and exchangeable P than inflow sediments. However, because of sediment deposition within the reservoir, outflow volume concentrations of sediment total P decreased fourfold as compared with inflow sediments. (Sims-ISWS)
W80-01872

CONTAMINATION OF GREAT SMOKY MOUNTAINS TROUT STREAMS BY EXPOSED ANAKEESTA FORMATIONS,
Western Carolina Univ., Cullowhee, NC. Dept. of Chemistry.
J. R. Bacon, and R. P. Maas.
Journal of Environmental Quality, Vol 8, No 4, p 538-543, October-December 1979. 4 Fig, 3 Tab, 18 Ref.

Descriptors: *Pyrite, *Environmental effects, *North Carolina, *Acid streams, *Water pollution sources, *Roadbanks, Acidic water, Leachate, Heavy metals, Geologic formations, Manganese, Zinc, Rock excavation, Water pollution, Acid streams, Sulfides, On-site investigations, Roads, *Great Smoky Mountains National Park, Anakeesta formations.

Anakeesta formations, prevalent geologic deposits in the Great Smoky Mountains National Park (GSMNP), when exposed to air and water, release an acid and heavy metal containing leachate into several GSMNP streams, renderin them virtually lifeless. Anakeesta pyrite affecting Beech Flats Creek was exposed during the construction of U.S. Highway 441, while exposures affecting Alum Cave Creek and Walker Prong are naturally occurring. The road cut on U.S. 441 at Beech Flats Creek acts as point source of various contaminants. The acidity increases 100-fold (pH 6.7 to 4.7) in the several hundred meters where the stream flows through a road cut fill area. Manganese and zinc were the main metallic ions introduced at the road cut. The zinc increased from 6 to nearly 200 ppb, and the manganese increased from an undetectable level to over 250 ppb. Seasonal variations below the road show a high concentration near 500 ppb in the summer to a low concentration near 100 ppb in the winter for both manganese and zinc. Both manganese and zinc showed the dilution effect expected going downstream away from the road cut. Alum Cave Creek and Walker Prong showed much lower levels of manganese and zinc and no point source could located. (Visocky-ISWS)
W80-01873

A MASS BALANCE STUDY OF APPLICATION OF MUNICIPAL WASTE WATER TO FORESTS IN MICHIGAN,
Michigan State Univ., East Lansing. Inst. of Water Research.
T. M. Burton, and J. E. Hook.
Journal of Environmental Quality, Vol 8, No 4, p 589-596, October-December 1979. 4 Fig, 5 Tab, 31 Ref. EPA R005143-01.

Descriptors: *Waste water disposal, *Forests, *Nutrients, On-site investigations, Deciduous forests, Nitrogen, Nitrogen compounds, Nitrates, Phosphorus, Chlorides, Sodium, Denitrification, Pollutants, Path of pollutants, Leaching, Irrigation, Evapotranspiration, Runoff, Recharge, Precipitation(Atmospheric), Water balance.

A mass balance study of the effects of secondary municipal wastewater on phosphorus and nitrogen cycling was conducted in 1976 and 1977 on three 1.2-ha plots in a late successional, sugar maple forest in southern Michigan. The treatments included an unirrigated control plot and 5- and 10-cm/week wastewater application plots. The 10-cm/week site was deliberately overloaded hydraulically. Chloride concentrations at the 150-cm depth on the wastewater application plots did not approach input concentrations until the end of the 1976 irrigation season. Thus, 1977 data were emphasized in mass balance calculations. About 96% of the added inorganic nitrogen from 5 cm/week of wastewater application leached past the root zone. Application of 10 cm/week wastewater increased inorganic nitrogen 'retention' on a mass balance basis to 69% of input apparently as a result of denitrification under anaerobic conditions in the water-logged soils. However, the 10-cm/week application resulted in nitrate concentrations approaching those of wastewater input concentrations during peak runoff periods. The 10-cm/week application also resulted in death of trees in the lower areas of the forest where water tended to pool. Phosphorus retention by the system was 96.5% at an application rate of 5 cm/week but decreased to 66% when the irrigation rate was increased to 10 cm/week as a result of runoff losses. Changes in soils included increases available phosphorus and exchangeable magnesium and potassium in the top 15 cm of soil and increased sodium and chloride concentrations throughout the 150-cm depth sampled. (Sims-ISWS)
W80-01875

DETERMINATION OF AQUIFER TRANSPORT PARAMETERS,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie.
For primary bibliographic entry see Field 2F.
W80-01877

HEAT RECIRCULATION INDUCED BY THERMAL DIFFUSERS,
Delaware Univ., Newark. Dept. of Civil Engineering.
J. H. W. Lee, G. H. Jirka, and D. R. F. Harleman.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY10, Proceedings Paper 14929, p 1219-1231, October 1979. 7 Fig, 1 Tab, 4 Ref, 2 Append.

Descriptors: *Heat, *Heat balance, *Heat transfer, *Bodies of water, Recirculated water, Entrainment, Environmental engineering, Water cooling, Temperature, Electric powerplants, Thermal pollution, Momentum transfer, Hydraulics, Design, Model studies, Flow field, Diffusers, Dissipation.

A unidirectional, multiport, thermal diffuser discharges large quantities of condenser cooling water in the form of a line of turbulent heated jets near the bottom of the receiving waterbody. The large momentum input induces a large mixed flow compared with the discharge flow, causing rapid temperature reduction within a relatively small area. This paper presented the results of an experimental study which demonstrates that under certain conditions the large back entrainment demand coupled with momentum dissipation (due to bottom friction) of the diffuser plume may generate recirculation of the mixed flow back into the near field, leading to temperatures significantly higher than previously predicted. Length and time scales of recirculation are estimated: the transient maximum temperature rise is correlated with the length scale of recirculation and the sink strength. (Viscosky-ISWS)
W80-01879

TIDAL AND SEASONAL VARIATIONS OF TRACE ELEMENTS IN TWO CORNISH ESTUARIES,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2L.
W80-01884

SEDIMENT HYDROCARBONS NEAR AN OIL RIG,
Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry.
T. F. Lytle, and J. S. Lytle.
Estuarine and Coastal Marine Science, Vol 9, No 3, p 319-330, September 1979. 3 Fig, 5 Tab, 42 Ref.

Descriptors: *Sediments, *Organic compounds, *Water pollution, *Coasts, *Texas, Aromatic compounds, Sampling, Analytical techniques, Analysis, On-site investigations, Chemical analysis, Gas chromatography, Water pollution sources, Oil, Coastal structures, Environmental impact studies, Oil rig, Olefins, Aliphatic hydrocarbons.

Sediment samples were collected from 25 strategic locations at a site on the Texas shelf before emplacement of an exploratory oil rig, during drilling, and after the rig had been in place for 2 months. These sediments were analyzed for aliphatic and aromatic hydrocarbons, and 13 gas chromatographic parameters, used in assessing pollution, were calculated. Graphic cluster analysis, analysis of variance, and discriminant analysis were applied to these parameters to view changes as well as to evaluate the effectiveness of gas chromatographic data in monitoring sediment hydrocarbons. Changes discernible by these techniques were slight but more noticeable at stations close to the rig. Hydrocarbons in the C14 to C30 region of the aliphatic chromatograms were in low abundance in all samples but consisted mostly of n-C17 and C25 branched-chain olefins. The high molecular weight region contained high concentrations of the odd carbon numbered n-alkanes with a predominance of n-C29. This similarity to terrestrial hydrocarbons was further confirmed by a mean delta C13 value vs. PDB of -28.0 parts per thousand for the aliphatic hydrocarbons. (Humphreys-ISWS)
W80-01885

WINTERTIME RAW-WATER CONTAMINATION AT CHICAGO'S SOUTH WATER FILTRATION PLANT,
Argonne National Lab., IL.
W. Harrison, D. L. McCown, K. D. Saunders, and J. D. Ditmars.
Journal of the Water Pollution Control Federation,

Vol 51, No 10, p 2432-2446, October 1979. 7 Fig, 3 Tab, 16 Ref.

Descriptors: *Illinois, *Water supply, *Lake Michigan, *Water pollution, On-site investigations, Water pollution sources, Tracers, Tagging, Samarium, On-site data collections, Path of pollutants, Analytical techniques, Analysis, Winter, Winds, Water temperature, Rainfall, Currents(Water), Lakes, *Chicago(IL).

The chief contributor to water pollution at the intakes for Chicago's South Water Filtration Plant is effluent from the Indiana Harbor Canal, Transported northward as a sinking plume by coastal currents in southwestern Lake Michigan. Canal water was injected with a complexed rare earth element, samarium. Subsequent samples containing the element provided unequivocal evidence for transport and mixing of the entire canal effluent, for the environmental conditions during the experiment, indicates a minimum dilution of 2.8 in the plume offshore of the treatment plant and 130 and greater than 100,000 at the shore and crib intakes, respectively. The worst-case potential pollution event was calculated from wind and rainfall. (Humphreys-ISWS)
W80-01886

GREAT LAKES TOTAL PHOSPHORUS BUDGET FOR THE MID 1970S,
National Oceanic and Atmospheric Administration, Ann Arbor, MI.
S. C. Chapra, and W. C. Sonzogni.
Journal of the Water Pollution Control Federation, Vol 51, No 10, p 2524-2533, October 1979. 2 Fig, 6 Tab, 37 Ref.

Descriptors: *Great Lakes, *Lake Erie, *Lake Ontario, *Lake Michigan, *Lake Huron, *Lake Superior, *Mathematical models, *Phosphorous, Nutrients, Water pollution, Water quality, Data collections, Model studies, Annual, Analytical techniques, Analysis, Systems analysis, Phosphorous budget, Sediment losses.

A mathematical model was used to synthesize recent information on the major fluxes of total phosphorus within the Great Lakes system. The model, which uses an annual time frame, consists of a coupled set of algerbraic equations representing material balances of the sources and sinks of total phosphorus for the major segments of the Great Lakes. The magnitude of sediment losses and intersegment effects were investigated by mathematical manipulations of the model. The latter demonstrates the impact of Detroit River loadings on the phsophorus levels of Lakes Erie and Ontario and generally shows that, because of the interdependence of its parts, the Great Lakes must be viewed from a system's perspective rather than as a series of individual, isolated entities. The consequence of such a perspective to water quality management is that uniform treatment of sources, while convenient from a political or legal standpoint, is economically suboptimal. (Humphreys-ISWS)
W80-01887

NUMERICAL SIMULATION OF GAS FLOW IN SANITARY LANDFILLS,
Stanford Univ., CA. Dept. of Civil Engineering.
A. N. Findikakis, and J. O. Leckie.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Proceedings Paper 14896, p 927-945, October 1979. 8 Fig, 1 Tab, 24 Ref, 1 Append.

Descriptors: *Model studies, *Landfills, *Gases, *Migration, *Municipal wastes, Numerical analysis, Porous media, Methane, Carbon dioxide, Nitrogen, Air-earth interfaces, Anaerobic bacteria, Leachate, Organic acids, Wastes, Stabilization, Equations, Biodegradation, Gas flow, Gas production, Finite-difference method.

The stabilization of refuse placed in sanitary landfills and the quality and rate of production of gases in landfills are principally the result of complex biological processes. A numerical model has been developed for simulating one-dimensional flow of a mixture of methane, carbon dioxide, and nitrogen through sanitary landfills. Finite-difference approximations to the differential gas flow equations were derived with an implicit time stepping scheme. The nonlinear finite-difference equations were solved iteratively using the Newton-Raphson method. An explicit formulation was also explored, the time step size required for stability was prohibitively small. The boundary condition at the landfill-air interface includes the assumption that the total pressure cannot drop below atmospheric pressure within a thin layer at the top of the landfill cover. The model was applied to data from two recent landfills. The pressure and concentration profiles predicted by the model are close to field observations. (Visocky-ISWS)
W80-01895

TARP GROUNDWATER MONITORING, SUMMARY REPORT (OCTOBER, 1976-SEPTEMBER, 1977),
Metropolitan Sanitary District of Greater Chicago, IL. Research and Development Lab.
B. Washington, and A. W. Obayashi.
Report No 78-9, June 1978. 36 p, 4 Fig, 2 Tab, 4 Ref, 1 Append.

Descriptors: *Groundwater, *Monitoring, *Illinois, *Water quality, Observation wells, Biochemical oxygen demand, Coliforms, Water pollution, Water sampling, Water properties, On-site investigations, On-site data collections, Hydrogen ion concentration, Chlorides, Hardness(Water), Mercury, Alkalinity, Phosphorus, Phenols, Conductivity, Chemical oxygen demand, Suspended solids, *Chicago(IL), Fecal coliform, Cyanide.

The Metropolitan Sanitary District of Greater Chicago is presently in the process of implementing its Tunnel and Reservoir Plan (TARP) to eliminate pollution of the waterways and local flooding in the Chicago land area. Since October, 1976, a series of 18 monitoring wells have been regularly sampled for indications of pollution. Four of these wells are located adjacent to the existing Southwest-13A tunnel in suburban McCook and provide information relative to the effect of TARP on groundwater quality in the general vicinity of this tunnel segment. The remaining wells are located adjacent to proposed tunnels (and the Summit-McCook reservoir) and provide baseline data characterizing the present groundwater quality in the respective areas. The data obtained from the 4 Southwest-13A monitoring wells from October, 1976, through September, 1977, showed no incidence of pollution attributable to combined sewer overflows being conveyed in the tunnel. Key pollution indicators (BOD and fecal coliform counts) have been consistently low (averaging 1 mg/l BOD and less than 1 fecal coliform organism/100 ml of sample, respectively), even during periods of relatively high water levels in the tunnels when significant tunnel exfiltration may occur. (Humphreys-ISWS)
W80-01896

THE EFFECTS OF TOLUENE ON EMBRYOS AND FRY OF THE JAPANESE MEDAKA ORYZIAS LATIPES WITH A PROPOSAL FOR RAPID DETERMINATION OF MAXIMUM ACCEPTABLE TOXICANT CONCENTRATION,
State Univ. of New York Coll. at Brockpost. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-01922

SECONDARY SALINIZATION AND SODICATION IN EGYPT: A CASE STUDY,
Alexandria Univ. (Egypt). Dept. of Soil and Water Science.
M. M. El-Gabaly.
Water Supply and Management, Vol 3, No 3, p 179-199, 1979. 6 Tab, 26 Ref.

Descriptors: *Saline soils, *Alkaline soils, *Salinity, *Soil management, *Water management(Applied), *Saline water, Asessments, Land management, Water table, Root zone, Salt balance, Irrigation canals, Leaching, Water quality, Soil chemical properties, Irrigation water, Farm management, Drainage, Monitoring, Egypt.

The development of secondary salinization and sodication in arid Egypt involves both natural and man-made factors including soil, climate, water, and management. The present review, aiming at a better assessment of land resources affected by secondary salinization are identified as poor levelling, fallowing, cropping patterns, insufficient leaching, and formation of a plowsol layer resulting from repeated tillage at a given depth. Procedures and programs are recommended to alleviate the problem of secondary salinization (2) changing surface and root zone salinity, (3) establishing a salt balance within a given area, (4) creating changes in micro-relief, (5) reducing seepage from water courses and adjacent land, (6) monitoring soil productivity, and (7) monitoring changes in the salinity of irrigaion canals. (Tickes-Arizona)
W80-01954

5C. Effects Of Pollution

WATER POLLUTION CONTROL IN THE REPUBLIC OF CHINA,
Taiwan Water Resources Planning Commission, Taipei.
L. T. Hsueh.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, Feb. 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Pergamon Press Inc. in U.S.A. Asian Institute of Technology, Bangkok, Thailand, p 3-7. 1 Tab.

Descriptors: *Water pollution control, *Republic of China, *Developing countries, Damages, Effects, Legislation, Industrial wastes, Domestic wastes, Physical features, Programs, Executive agencies.

Presented is a country report of water pollution control in the Republic of China. Owing to population increase, rapid growth of industry and expansion of urbanization, the extent of water pollution ranges from moderate to serious along the downstreams of most rivers in Taiwan. The main sources of pollution are industrial and domestic wastes. This paper reviews the physical features, present status of water pollution, damage caused by pollution, and control measures including legislation, the work of executive agencies and control programs implemented so far. (Bell-Graf--Cornell)
W80-01608

AN INVESTIGATION OF PROPOSED EFFLUENT DISCHARGE INTO A TROPICAL MANGROVE ESTUARY,
Department of Construction, Phillip (Australia).
D. A. Henley.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc. in USA), p 43-64, 1978. 1 Fig, 11 Tab, 5 Equ, 1 Ref.

Descriptors: *Effluents, *Discharge(Water), *Mangroves, *Estuaries, *Environmental effects, *Tropical regions, Oceanography, Pollutants, Lagoons, Sediments, Phosphorus, Nitrogen, Foliage, Equations, Statistical methods, Dispersion coefficient, Mass balance, Tides, Mixing, Nutrient status, Darwin(Australia).

Described are environmental studies carried out to determine the likely effects of effluent discharge into a mangrove-fringed estuary at Darwin in northern Australia. The oceanographic studies are described together with the statistical method used to calculate likely buildup of pollutants within the estuary. Studies of the nutrient status of the mangroves, including their sediments, are also described. They were used to assist in determining likely effects on the mangroves of an increase in nutrient. It was concluded that effluent from a primary-secondary lagoon system could safely be discharged within the mangrove areas with no detrimental effect. (Bell-Graf--Cornell)
W80-01613

INTEGRATED APPROACH TO POLLUTION CONTROL SURAT, INDIA: A CASE STUDY,
S. V. Regional Coll. of Engineering and Technology, Surat (India). Department of Civil Engineering.
R. N. Shelat, S.N.V Vashi, and S.N.V. Subbayya.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology Bangkok, Thailand (Pergamon Press Inc. in USA), p 111-116, 1978. 1 Fig, 2 Tab.

Descriptors: *Effects, *Urbanization, *Environmental control, *Surveys, *Pollution abatement, *Developing countries, *Surat(India), Air pollution, Water pollution, Solid wastes, Planning, Urban development, Density patterns, Pollution levels.

The importance of environmental quality in a developing country such as India has recently attracted a great deal of interest. Water, air and land, the vital resources of life, are incresingly being polluted in the wake of population growth, industrialization and urbanization in developing countries. The study reported herein has been carried out by conducting short-term air, water and land pollution serveys of Surat, India to establish the current levels of pollution. An attempt has been made to show the relationships between density patterns and pollution levels, and between unplanned and planned urban development and pollution levels, thus emphasizing integrated planned development as a preventive measure for arresting pollution levels in fast-growing urban centers. (Bell-Graf-Cornell)
W80-01619

STRUCTURAL DESIGNS AND PROBLEMS FOR WATER POLLUTION CONTROL,
Irrigation Commission, Lucknow (India).
A. C. Chaturvedi.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, V.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 117-121, 1978. 11 Ref.

Descriptors: *Structural design, *Water pollution control, *India, *Developing countries, *Effects, Water quality, Groundwater, Waste water(Pollution), Management, Benefits, Measurement, Industrial disposal, Modeling, Optimization, Separation, Dilution.

Eighty percent of the villages in India suffer from the lack of safe drinking water facilities and most of India's population is exposed to serious pollution hazards. Methods of pollution control have to be constantly reviewed and practical aplications are being sought in physical modeling and computer simulation in environmental problems related to river, lake and marine ecosystems, water resources and pollution, and air quality and pollution dispersion--all in the context of urban and regional development. Incidents of pollution dispersion--all in the context of urban and regional development. Incidents of pollution which occur in varying degrees of severity either during construction or in operation are not complicated by the use of new construction materials. However, unexpected incidents and more complex design forms have complicated the straight-forward demands of safety requirements. Some of the major factors that affect the pollution of modern structures are discussed. (Bell-Graf--Cornell)
W80-01620

THE ROLE OF NUTRIENTS AND THEIR EFFECTS ON THE BIOTA IN FRESHWATER LENTIC SYSTEMS,
North Eastern Hill Univ., Shillong (India). Dept. of Zoology.
J. R. B. Alfred, S. Kaur, and M. P. Thapa.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand, (Perfamon Press Inc. in USA), p 133-139. 1978. 4 Tab, 17 Ref.

Descriptors: *Nutrients, *Effects, *Freshwater, *Lenthic environment, *Ponds, *Oligotrophy, *Eutrophication, *Seasonal, Phytoplankton, Zooplankton, Sampling, Water pollution, Adaphic factors, Allochthonous materials, Autochthonous materials, Pisciculture.

Critical edaphic factors and the role of allochthonous and autochthonous materials in the seasonality of nutrients are inadequately assessed with particular reference to organic production in water bodies at higher altitudes. This study attempts to reveal the effects of nutrients in two ponds, one of which is fertilized for pisci-culture and the other a natural oligotrophic system. The biotic seasonality, with reference to abiotic factors operating at these extreme conditons, was studied. An experimental study under natural conditions has not only a pronounced academic perspective, but also an immediate applicability - in particular, to the role of nutrients and their effects on pollution. The seasonality of phytoplankton, the presence of only certain species, and their effects on pollution. The seasonality of phytoplankton, the presence of only certain species, and their succession are discussed, and an overall analysis elucidates the different stages of pollution. (Bell-Graf--Cornel l)
W80-01622

BENTHIC MACROINVERTEBRATE AND FISH AS BIOLOGICAL INDICATORS OF WATER QUALITY, WITH REFERENCE TO COMMUNITY DIVERSITY INDEX,
Taiwan Water Pollution Control Agency, Taichung,
C. D. Lee, S. B. Wang, and C. L. Kuo.
In: Water pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Editedby E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 233-238, 1978. 1 Tab, 14 Ref.

Descriptors: *Water quality, *Benthic animals, *Fish, *Invertebrates, *Biological indicators, *Community diversity index, Waste water(Pollution), Streams, Environmental effects, Evaluation, Rivers, Downstream, Upstream, Developing countries, Taiwan(China).

The community diversity index of benthic macroinvertebrates and fish can be an efficient and effective tool for quantifying the impact of wastewater pollution on stream environments. The full-scale evaluation of stream environments can be more accurately determined if indicator organism systems are applied to facilitate water quality assessments. Examples of proper indicator organisms are: Hydropsyche formosae, Neoporla sp., Eubrianax sp., Sigara sp., Acheilognathus himontegus, Rhinogobius similis, Pseudogobio brevirostris, Zacco temmincki, Caridina denticula, Macrobrachium asperulum, Macrobrachium japonicum, Thiara granifera, Gambusia patruelis, Tilapia mossambica, Eriocheir japonicus, and Ophidonais sp. In terms of biological assessment, almost all the upstream parts of 15 major rivers in western Taiwan have good water quality for aquatic life. However, half of the downstream parts of these rivers have been exposed to moderate or even heavy contamination. (Bell-Graf--Cornell)
W80-01632

THE IMPORTANCE OF INDUSTRIAL EFFLUENT SURVEYS AND EFFECTS IN THE ECONOMICAL CONTROL OF WATER POLLUTION,
International Consulting and Lab. Services (England).
S. H. Jenkins, and R. K. Chalmers.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology Bangkok, Thailand (Pergamon Press in USA), p 287-305, 1978. 6 Fig, 8 Tab, 2 Ref.

Descriptors: *Industrial wastes, *Effects, *Surveys, *Water pollution control, *Economics, Effluents, Environment, Methodology, Combined sewers, Treatment facilities, Industries, Activated sludge, Estuaries, Data collection, Pollution load, Lagoon of Venice, Chemical concentrations, Toxicants, Developing countries.

A number of Western countries have foregone environmental protection in the past in favor of industrial development. It is only recently that they have realized the significance and necessity of environmental protection. The same trend could be found in developing countries where industry has been established firmly before the government tries to consider pollution problems; case studies in Europe on the need of intensive industrial effluent surveys and its significance on economic development have been reviewed and the applicability of the methodology and techniques to developing countries is discussed. Considered are: (1) the importance of eliminating toxicants from combined sewage and industrial effluent treatment systems; (2) investigating the load due to industry in a sewage treatment plant dominated by industrial wastes; (3) pollution control in the lagoon of venice; (4) method of survey to obtan data for a predictive model of a polluted estuary; and (5) estimating the cost of comprehensive water pollution studies. (Bell-Graf--Cornell)
W80-01637

WASTEWATER RECOVERY--OBJECTIVES AND MEANS,
Taylor (John) and Sons, London (England).
D. G. M. Roberts.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 309-314, 1978.

Descriptors: *Waste water(Pollution), *Reuse, Industrial water, Agricultural reuse, Indirect reuse, Health risks, Effluents, Standards, Purification processes, Amenity, Fish farms, Unpurified sewage, Sludge.

Wastewater reuse can substantially reduce a region's net abstraction of water. Direct reuse by agriculture or industry requires careful control and standby disposal arrangements. All effluents contain some pathogens and measures must be taken to reduce the health risks to operatives and consumers. Acceptable effluent standards are proposed and suitable treatment processes described. Reuse for amenity and in fish farms, indirect reuse, the dangers of reusing crude sewage and the utilization of liquid or dewatered sludge are considered. Situations where reuse is being practiced and the administrative requirements for effective reuse are described. (Bell-Graf--Cornell)
W80-01638

COMPOSITING OF CENTRIFUGED SLUDGE CAKE,
Japan Sewage Works Agency, Saitama. Technology Development Div.
A. Sugiki.
In: Water Pollution Control in Developing Countries. Proceedings of the International, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 697-700, 1978. 1 Tab, 3 Fig.

Descriptors: *Sludge, *Solid wastes, *Sewage, *Composting process, *Heavy metals, *Experiments, Agriculture, Rice, Barley.

This paper investigates the optimum conditions of the sewage sludge composting process and concentrations of heavy metals in sewage sludge. Experiments showed that: (1) after 1 or 2 days, the temperature of sewage sludge rose to 70C when moisture concentration was well controlled--good

results were obtained after about one week of fermentation and one month of curing; (2) the heavy metal concentrations in sludge cakes produced at domestic sewerage treatment plants were found to be within the standard level (Cd<=5, Hg2<=, As<=50 mg/kg on dry base). (Bell-Graf--Cornell)
W80-01672

SOME PUBLIC HEALTH ASPECTS OF LEACHATE FROM LANDFILLS,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5E.
W80-01676

LEVEL-B MULDUAL-PURPOSE DETENTION BASINS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 4A.
W80-01679

ASSESSMENT OF THE ENVIRONMENTAL INFRASTRUCTURE REQUIRED BY LARGE PUBLIC AND PRIVATE INVESTMENTS,
Harvard Univ., Cambridge, MA. Dept. of City and Regional Planning.
M. Shapiro, D. F. Luecks, and J. Kuhner.
Journal of Environmental Management, Vol 7, No 2, p 157-176, September 1978. 7 Tab, 2 Fig, 12 Ref.

Descriptors: *Water resources, *Sewage, *Assessment, *Environmental effects, *Economic impacts, *Investment, *Cross-Florida Barge Canal, *Secondary impacts, Planning, Capital, Projects, Methodology, Forecasting, Mathematical models, Treatment facilities, Systems analysis, Fiscal impact, Infrastructure costs, Population projections, Disaggregation, Inventory.

Large capital projects, such as highways and barge canals, may induce significant residential, commercial and industrial growth. This paper discusses an approach for evaluating the infrastructure requirements of such secondary development. Issues considered include the level of detail and time horizon used in making projections, service area delineation, facility selection and staging, and the impacts of local and state government actions. The approach can be used to compute residual fluxes and to evaluate economic impacts such as changes in tax rates and user charges. The methodology is applied to assess certain of the secondary impact of the proposed Cross-Florida Barge Canal. A county-level aggregate economic forecasting model has been developed to assist in projecting the major economic and demographic trends in the canal region. (Bell-Graf-Cornell)
W80-01699

STATISTICAL METHODS USED TO ASSESS BIOLOGICAL IMPACT AT NUCLEAR POWER PLANTS,
Battelle Pacific Northwest Labs. Richland, WA. Ecosystems Dept.
J. M. Thomas, J. A. Mahaffey, K. L. Gore, and D. G. Watson.
Journal of Environmental Management, Vol. 7, No. 3, p 269-290, November 1978. 6 Fig, 7 Tab, 21 Ref.

Descriptors: *Statistical methods, *Assessment, *Environmental effects, *Nuclear powerplants, Analytical techniques, Mathematical models, Simulation analysis, Regression analysis, Ecology, Statistical models.

This paper illustrates and discusses a number of analytical procedures used to assess ecological impact studies conducted at three nuclear power stations. The advantages, disadvantages and limitations of each statistical procedure are discussed. It is suggested that use of one of these procedures, accompanied by a field design based on the same statistical model and field methods recommended by other studies, will be suitable for the detection of changes in biota. However, since litigation has been directed to the question of effects on future populations, a plan for conducting environmental monitoring studies is devised in which that question is addressed. (Bell-Graf--Cornell)
W80-01701

ON THE PRODUCTIVITY AND CHEMICAL COMPOSITION OF SOME BENTHIC ALGAE IN HARD-WATER STREAMS,
C. Muller.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1457-1462. 1 Fig, 4 Tab, 14 Ref.

Descriptors: *Running waters, *Primary productivity, *Aquatic algae, *Chemical analysis, *Photosynthesis, Productivity, Rivers, Biomass, Chlorophyll, Cladophora, Lotic environment, Hardness(Water), Chlorophyta, Sweden.

Estimated approximate maximum specific photosynthetic rate for Cladophora is 5.94, for Vaucheria, 2.16, and for Lemanea, 45.6 mg O2/mg chlorophyll-a hr, indicating high productivity; however, the importance of Lemanea in the ecosystem might be limited since it disappears when the water temperature reaches a certain level. This paper estimates productivity of three representative algal communities from some hard-water streams in southern Sweden. Samples of Vaucheria sp. (River Tolangaan), Cladophora glomerata (River Trydean), and Lemanea fluviatilis (River Verkean) were collected in August-October 1976. The standing crop of Cladophora and Lenmanea were much higher than the standing crop of Vaucheria per sampling area bases. The ash content of Lemanea was low, 3-5%, and calcium and iron contents below 0.5%. In Cladophora and Vaucheria, the ash content was 20-25%, mainly due to calcium carbonate deposits. The potassium content was high, ranging 1-2%. The chlorophyll content of Lemanea was only 61.2 micro g sq dm when maximum biomass occurred, about one-tenth the maximum Cladophora chlorophyll content. As the experiments were run under laboratory conditions, the values were thought to reflect potential algal productivity. Cladophora showed highest gross production values in September with 0.630 mg O2/hr/g Fw and Vaucheria the lowest gross production values in October, 0.069 mg O2/hr/g Fw. The net productivity of Vaucheria was below zero, indicating respiration predominating over production. (Danovich-Wisconsin)
W80-01703

ROLE OF THE ORGANIC LAYER ON STONES IN DETRITAL METABOLISM IN STREAMS,
Umea Univ. (Sweden). Dept. of Ecological Zoology.
U. Karlstrom.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1463-1470. 5 Fig, 3 Tab, 15 Ref.

Descriptors: *Rivers, *Decomposing organic matter, *Organic matter, *River beds, Running waters, Lotic environment, Benthic fauna, Sweden, Detritus, Degradation(Stream), Aquatic habitats, Mosses, Aquatic environment, Metabolism, Respiration, Microorganisms.

Assuming maximum respiration rate of five g O2/sq/m/d for all heterotrophes and a mineralization rate of 7.5 g organic matter sq m/d, maximum detrital processing capacity is 15 g/d for an average 100 m section of rapids along a relatively large stream. With a six cu m/sec discharge and one mg/l seston load, 500 kg/d is transported through this section, showing the function of running waters as transport channels for their drainage basins. Therefore, the major effects of suspended organic matter will not be found in streams, but outside their ecosystems. River Ricklean is an ungraded, fifth-order stream in northern Sweden with maximum discharge of 160-180 cu m/sec and minimum discharge of 3-10 cu m/sec. It is a fairly typical forest river, 48 km long with rapids constituting 16% of its length. The river bed stones' organic layer harbours an abundance of protozoans and micrometazoans. The 1975-1977 study revealed a considerable amount of organic matter on the stones, up to 354.8 mg/cu dm stone volume. A tentative estimate of the total benthic community respiration was compiled with a maximum Fontinalis community respiration of 3.6 g O2/sq m/d. The community respiration of the hyporheic habitat was estimated by measuring the top four cm, an underestimation. The total respiration was regarded as a tentative estimate of the maximum decomposition rate of the rapids. (Danovich-Wisconsin)
W80-01704

AQUATIC MOSSES AND STREAM METABOLISM IN A NORTH SWEDISH RIVER,
Umea Univ. (Sweden). Dept. of Ecological Zoology.
T. Johnson.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 1471-1477. 9 Fig, 7 Ref.

Descriptors: *Rivers, *Mosses, *Metabolism, *Respiration, Sweden, Benthic fauna, Running waters, Lotic environment, Aquatic habitats, River beds, Aquatic environment, Growth rates, Standing crops, Oxygen demand.

The role of the Fontinalis moss community is related to the general pattern of metabolism and function of detritus in the rapids of the River Ricklean, Sweden a meso-humic woodland river. The community consumes a maximum of 0.26 g oxygen sq m/h compared with maximum values for the stone community, 0.05 g O2/sq m/h, and the uppermost part of the hyporheic community, 0.03 g/O2/sq m/h. Standing crop was calculated from 20 random samples, and one sq m samples were taken from a 50 m long section rapid during August low water. Among the macrophytes, mosses dominated strongly. Of the four species of moss vegetation, Fontinalis dalecarlica covered 80% of the bottom area with 430 g Dw/sq m. Amounts of up to 770 g/sq m were obtained and on stable bottom areas of boulders of sand. Oxygen consumption and shoot growth were used as metabolism parameters. According to shoot growth, the vegetation period starts in ince-free parts of rapids with temperatures of the 0C range with highest growth rate slightly before the highest temperature. Respiration measurements show a relatively high activity at low temperatures, 0.15 g O2/sq mgh. The structure of the moss organic surface layer ranges from diatoms and bacteria on young shoots to fungal hyphae, interwoven with particles into a thick web, completely covering older parts. (Danovich-Wisconsin)
W80-01705

DYNAMICS OF THE PHYTOPLANKTON IN THE RIVER LOT,
Toulouse-3 Univ. (France). Lab. d'Hydrobiologie.
J. Capblanco, and H. Decamps.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1479-1484. 3 Fig, 1 Tab, 12 Ref.

Descriptors: *Rivers, *Phytoplankton, *Photosynthesis, *Chlorophyta, Low flow, Lotic environment, Respiration, Biomass, Growth rates, Chlorophyll, Chemical analysis, Aquatic algae, Marking techniques, Tracking techniques, Currents(Water), On-site data collections.

The relationship between the photosynthetic activity of algae, measured by the C14 method or by oxygen, and the increase in biomass in the Lot River, France, is variable and can be determined only by simultaneously measuring algal respiration. Photosynthesis rate ranged 136-919 mg C/cu m/d and increase in biomass ranged 51-188 mg C/cu m/d. Comparing daily rates of photosynthetic assimilation and increase in biomass indicates that organic matter rapidly degrades. Only 20-25% of assimilated carbon returns to new biomass. This paper monitors a moving mass of marked water over a distance of 52 km, on the river during low flow to examine the dynamics of the inhabiting phytoplankton. The experiment took place on August 20-25, 1975, with regularized water flow of 16-19

cum m/sec. The water was marked with rhodamine. Chemical, biological, and physical parameters were measured and analyzed. Chlorophycae represented 70-90% of the algae volume, with Coelastrum reticulatum being the dominate species and showing the highest growth rate, from 500 cells/ml to 50,000 cells/ml. The water was subject to continuous mixing and the abundance of mineral and organic matter in suspension reduced light penetration, increasing the relative time spent by algae in darkness and reducing net algae production. The carbon assimilated and degraded corresponds to nearly 50% of the rate of oxygen consumption although this value is still in question. (Danovich-Wisconsin)
W80-01706

FACTORS THAT DETERMINE THE BENTHIC SECONDARY PRODUCTION IN TWO LAKE OUTFLOWS--A CYBERNATIC MODEL,
Kiel Univ. (Germany, F.R.). Zoologisches Inst.
B. Statzner.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1517-1522. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Benthic fauna, *Secondary productivity, *Comparative productivity, *Model studies, *Upper Schierenseebrook(West Germany), *Lower Schierenseebrook(West Germany), Runoff, West Germany, Running waters, Invertebrates, Discharge(Water), Cycles, Aquatic productivity, Food chains, Ecosystems, Ecological distribution, Spatial distribution, Productivity, Biomass, Dominant organisms, Habitats, Environmental effects.

A cybernetic model study about the dependence of benthic secondary production on biological and environmental factors concludes that knowledge of energy pathways does not necessarily lead to an understanding of a system, in contrast, the coincidence of some very small biological details of the species involved to a large extent determines the character of the outflow communities. A 1974-1975 field study was carried out in two lake-fed brooks in northern Germany to investigate classification of running water ecosystems. The running waters, named the Upper and Lower Schierenseebrook, are situated between three eutrophic lakes near Kiel. Nearly 385,000 macroinvertebrates were collected in benthon, drift, corer, net captures, and artificial substrate samples. Greatest abundance of filter feeders was found just below the lakes and was mainly caused by Neureclipsis bimaculata (Trichoptera) and Dreissena polymorpha (Bivalvia). Since the annual benthic production of the Upper stream was 592 kcal sq m and the Lower stream was 1557 kcal sq m, a cybernetic model was developed based on the four most important species and environmental factors to explain the differences in the production of filter feeders. Many external factors such as lake and riparian vegetation affected the community, clearly demonstrating the ecotone characteristics of the outflow systems. (Danovich-Wisconsin)
W80-01708

EVALUATION OF THE MESH BAG METHOD FOR STUDYING LEAF COLONIZATION BY STREAM INVERTEBRATES,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
M. J. Winterbourn.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1557-1561. 3 Fig, 6 Ref.

Descriptors: *Testing procedures, *Materials testing, *Invertebrates, *Midges, *Diptera, On-site data collections, Data collections, Sampling, *Leaves, Running waters, New Zealand, Food chains, Habitats, Larvae, Water beetles, Mayflies, Caddisflies, Niches, Stoneflies, Biological communities, On-site tests, On-site investigations.

The major drawback of mesh bag methods for studying leaf colonization in a 1976 New Zealand small forest stream field experiment is that it is impossible to distinguish between animals associated with leaves and those on the bags themselves. Similar species numbers and the same species were taken from bags with and without leaves and comparable invertebrate densities were found in all bags when considered as numbers per total surface area available for colonization. The study: (1) measured weight and area leaf changes in bags of two mesh sizes which were exposed to the stream community; (2) examined size and composition of invertebrate fauna colonizing the bags; and (3) investigated colonization effects of the bags themselves. Green leaves of a single branch of red beech, Nothofagus fusca, were dried and used. Three bags of each type (40 leaves, 80 leaves, plastic squares, empty, 0.2 mm mesh, one mm mesh) were placed in three 10 mm nylon sacks which were anchored to the stream bed and at 25, 73, and 112 day intervals one sack was removed. Leaf weight loss was greater in coarse-mesh than fine-mesh bags. Twenty-five invertebrate species were found including an abundance of larval Chironomidae in all bags, and other important taxa such as two stoneflies, Zelandobius confusus and Spaniocerca zelandica, a caddisfly, Zelandopsyche ingens, and an helodid beetle larvae. Mean midge densities per total surface area were similar in all coarse mesh bags suggesting that leaves were not preferentially selected substrates for chironomid larvae. (Danovich-Wisconsin)
W80-01709

PHYTOPLANKTON ECOLOGY OF SHATT AL-ARAB RIVER AT BASRAH, IRAQ,
Bangladesh Agricultural Univ., Mymensingh. Faculty of Fisheries.
M. F. HuQ, H. A. Al-Saadi, and H. A. Hameed.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1552-1556. 2 Fig, 18 Ref.

Descriptors: *Diatoms, *Phytoplankton, *Biological communities, *Ecological distribution, *Algae, Iraq, Sewage, *Shatt al-Arab River, Rivers, Cyanophyta, Chlorophyta, Benthic flora, Ecology, Distribution patterns, Distribution, Aquatic algae, Plankton, Plant groupings, Marine algae.

A total of 107 species, 74.7% of which were diatoms, were identified in a September 1976-May 1977 study of the Shatt al-Arab River at Basrah, Iraq. The river is formed by the Tigris and Euphrates rivers and flows 120 km into the Persian Gulf. Average discharge is 678 cu m sec and is 0.5 km wide at Basrah. It is also affected by diurnal tides with a 1.7 m average water level variation. The 0.5 million population city empties its untreated sewage into the river. Three stations near the city were sampled monthly; chlorsity varies 0.16-0.29 g l, pH 7.66-8.02, and DO 4.7-9.7 ppm. Phytoplankton totals show bimodal distribution, reaching maximum in November and March and minimum in December and May. The November peak is probably due to receding flood water and the March pulse is due to stable water levels. Besides the predominate pennate diatoms, green algae constitute 10.28% and blue-green algae 14.01% of total species. The most commonly occurring species are Bacillaria paradoxa, Cocconeis placentula, Diatoma vulgare, Rhoicosphenia curvata, and Synedra ulna. The population is dominated by benthic species (82.5%), and plankton constitute 15%, epiphytic species 2.5%. Freshwater species dominate (63%) compared to 21% brackish and 16% marine habitats. (Danovich-Wisconsin)
W80-01712

AN APPROACH TO MODELLING PRODUCTIVITY IN RESERVOIRS,
McGill Univ., Montreal (Quebec). Dept. of Biology.
M. L. Ostrofsky, and H. C. Duthie.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1562-1567. 1 Fig, 37 Ref.

Descriptors: *Phosphorus, *Nutrient budgets, *Mathematical studies, *Reservoirs, *Reservoir stages, *Smallwood Reservoir(Canada), Productivity, Cycles, Trophic levels, Nutrients, Equations, Curves, Nutrient loading, Leaching, Impoundments, Impounded waters, Lakes, Ecosystems, Phytoplankton, Model studies, Canada.

Leaching forest litter is the key nutrient source in the Smallwood Reservoir in Labrador, Canada. New reservoirs pass through a stage of high biological activity, trophic upsurge, and then give way to a much reduced activity stage, trophic depression, trophic upsurge, and then give way to a much reduced activity stage, trophic depression; this 1974-1975 study tested a phosphorus dynamics hypothesis for predicting magnitude and duration of reservoir stages. Weekly sampling during the ice-free season was carried out on the reservoir and an adjacent natural lake, Mile 83 lake. Primary productivity rates were higher in the reservoir in both years, 1974-1975, averaging 107-168 mg C sq m d, respectively, than in Mile 83 lake, 59-96 mg C sq m d, respectively. P budgets were constructed with the atmosphere contributing 0.44 kg P ha yr and the land surface exporting 3.72 mg P sq m yr. Predicted and observed P concentrations in the lake agreed but in Smallwood Reservoir the predicted P concentration (6.1 mg cu m) was less than 50% of the observed value (12.6 mg/cu m). The most obvious important P source overlooked was the inundated vegetation and soils. Mathematical studies on the mass balance equation and leaching input were performed and concluded that an average P contribution of 15 mg P/sq m resulted from leaching. P was graphed as a function of time and high P concentrations corresponded to trophic upsurge and decreasing P concentrations to that of trophic depression. (Danovich-Wisconsin)
W80-01713

ECOLOGICAL HETEROGENITY BETWEEN NORTH-TEMPERATE RESERVOIRS AND GLACIAL LAKE SYSTEMS DUE TO DIFFERING SUCCESSION RATES AND CULTURAL USES,
Ontario Ministry of Natural Resources, Thunder Bay.
R. A. Ryder.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1568-1574. 2 Fig, 1 Tab.

Descriptors: *Lake stages, *Reservoir stages, *Ecology, *Biological communities, *Succession, Ecosystems, Reservoirs, Lakes, Glaciohydrology, Ecological distribution, Adaptation, Evolution, Lotic environment, Environmental effects, Geographical regions, Climatic regions, Temperate, Productivity, Lentic environment.

This literature survey emphasizes that winter drawdown is the principle cultural use inducing greatest abiotic stress on north-temperate reservoir communities. The survey also compares ecosystem attributes and emergent properties of glacial lakes and reservoirs, and proposes the selection of a top fish predator to smooth transformations in biotic reservoir regimens. Creation of a large winter drawdown zone imposes severe stresses on fish, invertebrate bottom fauna, and macrophytes. The whole impoundment aquatic system retrogresses to a juvenescent successional lake ecosystem stage in which pelagic autrotrophy dominates as the simple food web base. While reservoirs are young on an evolutionary basis, they pass through early successional stages more rapidly than counterpart glacial lakes due to rapid nutrient augmentation from newly inundated substrate. A reservoir is a distinct king of tenuous ecosystem retaining specific lotic and lentic environmental characteristics. Ecosystem changes created by dam construction produce radical alterations to indigenous river communities which degrade rapidly because they are oriented primarily toward substrate, water surface, or shoreline interfaces and are replaced by pelagiphils from lake communities. Genetic selection of organisms such as top fish predator having the ability to opportunistically adapt to rapid and inequitable nutrient flux and the use of pelagic sites for metabolic activity would tend to dampen biotic oscillations and lessen radical departure from steady state. (Danovich-Wisconsin)
W80-01714

PHOSPHORUS REMOVAL BY SEDIMENTATION IN SOME IOWA RESERVOIRS,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
J. R. Jones, and R. W. Bachmann.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1576-1580. 2 Fig, 2 Tab, 16 Ref.

Descriptors: *Reservoirs, *Phosphorus, *Nutrient removal, *Sedimentation rates, Iowa, Lakes, Mathematical models, Sedimentation, Nutrient budgets, Cycling nutrients, Sediments, Reservoir silting, Impoundments, Model studies, Equations, Seasonal.

Sedimentation coefficients two orders of magnitude greater than those used for natural lakes were necessary to calculate summer phosphorus levels in Iowa reservoirs. Morphometric and watershed data were summarized and inflowing streams were monitored every 10-15 days for two years to estimate the annual TP inputs for Big Creek, Don Williams, Hickory Grove, and McFarland reservoirs. Various phosphorus models were used to predict reservoir concentrations but all models overestimated summer phosphorus values by three to ten times. A sedimentation coefficient of 37, as compared to 0.65 for natural lakes, was used in the Vollenweider equation, causing agreement between the observed and predicted phosphorus concentrations. Phosphorus levels in natural lakes did not change from spring to summer, but late summer values averaging 37% of spring phosphorus concentrations were found in reservoirs due to high phosphorus sedimentation rates. Because of high phosphorus sedimentation rates, phosphorus concentrations in reservoirs were less than would be expected from phosphorus loading models developed from natural lake data. (Danovich-Wisconsin)
W80-01715

PRIMARY PRODUCTIVITY AND PHYTOPLANKTON BIOMASS IN THE BIG EAU PLEINE RESERVOIR, WISCONSIN,
Wisconsin Dept. of Natural Resources, Rhinelander.
J. F. Sullivan.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1581-1586. 3 Fig, 2 Tab, 19 Ref.

Descriptors: *Primary productivity, *Reservoirs, *Biomass, *Phytoplankton, *Big Eau Pleine Reservoir(WI), Wisconsin, Wisconsin River, Chlorophyll, Light, Nutrients, Runoff, Phosphorus, Algae, Cyanophyta, Diatoms, Dominant organisms, Eutrophication, Productivity.

Phosphorus input and increased solar energy in summer 1976 provide optimal conditions for greater phytoplankton growth on the eutrophic Big Eau Pleine Reservoir, Marathon County, Wisconsin. The reservoir, located on the Wisconsin River, experiences annual water fluctuations up to nine m, dense blooms of Aphanizomenon flos-aquae during summer and fish kills due to low DO concentrations in winter. Agriculture, alone with municipal and industrial inputs, accounts for most nutrients. Average primary production rates for 1975 and 1976 were 1.29 and 3.00 g C sq m d. Average daily insolation was 31% higher during a summer 1976 than summer of 1975. Reactive phosphorus concentrations was high in spring as a result of runoff and accounted for 70-80% of the TP loading. TN and TP loading was higher in spring 1976, 23.0 and 2.27 kg ha, than 1975, 15.9 and 2.06 kg ha. A significant reduction (13%) in reservoir area in summer 1976 compared to 1975 may have artificially concentrated the blue-green algae. However, it was unlikely that reservoir drawdown was as important as increased primary productivity in increasing the phytoplankton biomass. Primary production increased 130% on an areal basis and was correlated with an 100% increase in phytoplankton biomass during the open-water period of 1976 as compared to 1975. (Danovich-Wisconsin)
W80-01716

LEAF BREAKDOWN AND INVERTEBRATE COLONIZATION ON A RESERVOIR BOTTOM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. R. Webster, and G. M. Simmons, Jr.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1587-1596. 2 Fig, 3 Tab, 42 Ref.

Descriptors: *Leaves, *Reservoirs, *Biodegradation, *Decomposing organic matter, *Claytor Lake(VA), Invertebrates, Lakes, Streams, Degradation(Decomposition), Habitats, On-site tests, On-site investigations, Sampling, Benthic fauna, Food habits.

Detrital consumers capable of direct or indirect utilization of leaf material contribute to leaf breakdown in Claytor Lake, western Virginia. This 1975-76 study examines breakdown rates of nine tree leaf species and one aquatic macrophyte on a reservoir bottom and macroinvertebrate colonization on four leaf species. Claytor Lake is a 1922 ha impoundment on New River and has a maximum depth of 36.5 m. In December, 1975 leaf bags in 10 groups were placed at four and seven m depths and were retrieved in January, March, May, July, and September 1976. For all species there is no significant difference between breakdown rates at these depths. Based on breakdown rates, leaves are classified into three groups: dogwood and cattail break down rapidly (0.01044-0.01038/d); sourwood, poplar, hickory and maple are in a medium group (0.00896-0.00817/d); and rhododendron, oak, chestnut, and sycamore break down slowly (0.00625-0.00325/d). Lake breakdown is faster than terrestrial breakdown but generally slower than stream breakdown for dogwood, hickory, poplar, maple, and sycamore leaves. Sourwood, chestnut, white oak, and rhododendron leaf breakdown in forests is slower than breakdown rates in Claytor Lake. However, rhododendron and white oak leaf breakdown rates are faster than stream breakdown rates. All leaf species exhibit an increase in the number of organisms/g Dw leaf material. A total of 18 taxa including Hyalella azteca, Asellus sp, Chironomidae, Planaria, and Oligochaeta are identified. (Danovich-Wisconsin)
W80-01717

LIGHT AND ZOOPLANKTON AS ALGAE REGULATING FACTORS IN EUTROPHIC BIESBOSCH RESERVOIRS,
Waterwinning-Bedrijf Brabante Biesbosch (Netherlands).
G. Oskam.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1612-1618. 4 Fig, 3 Tab, 6 Ref.

Descriptors: *Zooplankton, *Growth rates, *Reservoirs, *Light, *Limiting factors, *Biesbosch Reservoirs(Netherlands), Algae, Eutrophication, Pumped storage, Water supply, Mathematical models, Algal control, Phytoplankton, Netherlands, Biomass, Productivity, Nutrients.

According to a light-limited algal growth kinetic model for the two Biesbosch reservoirs in the southwestern Netherlands, a maximum algal biomass of 30-40 mg cu m chlorophyll was predicted, compared to observed maximum algal concentrations ranging 20-60 mg cu m chlorophyll in 1974-1977. Observed values on one reservoir were within the predicted range for the four years, whereas observed values exceeded the predicted range for the other reservoir in 1976 and 1977. The Biesbosch pumped-storage reservoirs, formed by the River Meuse, are used for public water supplies. Average total P and total N concentrations in the Meuse River water are higher than 0.5 mg/l and 5 mg/l, respectively. A model was developed to evaluate a light-limiting algal growth method and give predictions of maximum algal concentrations. Basic assumptions are that vertical algal distribution stays homogeneous because of an air injection system at the reservoir bottom, and that nutrients are not limiting factors. A mixing depth of 15 m, which was planned for the reservoirs to maintain the stored waters' chemical quality, could effectively restrict algal development to an acceptable level if the extinction coefficient were 1.0/m or more. Grazing by zooplankton populations, consisting predominantly of Cladocera (Daphnia and Bosmina) and to a lesser extent Copepods (Cyclops), also keeps algal biomass at much lower levels than light limitation would permit. (Danovich-Wisconsin)
W80-01720

STUDY OF THE PHOSPHORUS LOADING AND RETENTION IN IJSSELMEER,
Hydrobiologisch Inst., Nieuwersluis (Netherlands).
W. A. De Kloet.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1619-1623. 3 Fig, 1 Tab, 9 Ref.

Descriptors: *Phosphorus, *Phosphates, *Biological degradation, *Articicial lakes, *Nutrient removal, *Ketelmeer Lake(Netherlands), Eutrophication, Netherlands, Rivers, Sedimentation, Nutrient loading, Cycling nutrients, Phosphorus compounds, Water properties, Water quality, Lakes, Correlation analysis, Regression analysis.

A decrease in TP concentrations in Ketelmeer Lake which forms a transition between the Ijssel River and Ijsselmeer Lake, largest freshwater lake in the Netherlands, is due to phosphage and particulate P decreases. Decreased phosphate concentrations are caused by biological fixation, physicochemical fixation, and dilution with Ijsselmeer water. Half the phosphate concentration decrease is due to biological removal in Ketelmeer. Sedimentation to the Ketelmeer lake bottom plays a major role of particulate P decrease. The rate of eutrophication of Ijsselmeer has sharply increased since 1950 with a TP input of 7.7 million kg in 1969, 60% of this coming from Ijssel River. The present study investigates the role of Ketelmeer as a P sink and collected water samples from Ijssel River, Ketelmeer, and Ijsselmeer on four consecutive days each month from June 1971-March 1972. The average decrease in TP from Ijssel to Ketelmeer was 36.7% in summer and 28.9% in winter and was significantly correlated with distance. The average phosphate concentration was 41.6% lower in Ketelmeer than Ijssel in the summer and 18.4% in the winter. Average particulate P concentration in Ketelmeer was 30.4% lower in summer and 38.4% in winter than in Ijssel. (Danovich-Wisconsin)
W80-01721

BENTHOS TYPOLOGY OF SPANISH RESERVOIRS,
Barcelona Univ., (Spain). Dept. of Ecologia.
N. Prat.
In: Proceedings Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1647-1651. 1 Fig, 1 Tab, 9 Ref.

Descriptors: *Reservoirs, *Benthic fauna, *Classification, *Trophic level, *Spain, Diptera, Biomass, Oligochaetes, Tubificids, Ecosystems, Productivity, Standing crops, Eutrophication, Mesotrophy, Oligotrophy, Impoundments.

This July 1973-January 1975 study of 79 Spanish reservoirs classifies them according to benthonic organisms with a special emphasis on Chironomidae. Brundin's Lake classification sytem based on Chironomidae indicator species is used, although some Spanish biogeographic pecularities are evident. The typical European and American species characteristic of mesotrophic reservoirs, Stictochironomus rosenscholdi, is substituted by S. maculipennis in Spanish reservoirs. Dominant reservoir forms are Tubificidae (Oligocheate) representing 90% of total numbers and Chironomidae (Diptera) representing 9%. Only three Chironomidae genera are present in over 10% of reservoirs; Procladius (62%), Chironomus (48%), and Stictochironomus (29%), Spain has no ultraoligo-trophic reservoirs. Only one reservoir in an area of scarce human settlements and high altitude is classified with Brudin's group II, moderately oligotrophic

lakes with Tanytarsus as indicator species. Light sediment, no severe anoxia, relatively deep, and Chironomidae absence characterize mesotrophic reservoirs. This classification is modified to include some Chironomidae, namely Procladius and Stictochironomus, but not Chironomus. Eutrophic reservoirs include Chironomus and Stictochironomus and generally are shallow with high average biomass (5.6-9.7 mg chl a cu m). Chironomus colonization is prevented in ultraeutrophic reservoirs by extreme oxygen depletion and depth. (Danovich-Wisconsin)
W80-01723

FACTORS GOVERNING TURBIDITY IN A SOUTH AFRICAN RESERVOIR,
R. D. Walmsley.
In: Proceedings: Congress in Denmark 1977. Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1684-1689, 3 Fig, 7 Ref.

Descriptors: *Turnovers, *Reservoirs, *Water circulation, *Transparency, *Turbidity, *Thermal stratification, *Lindleyspoor Dam(South Africa), South Af+rica, Stratification, Secchi discs, Destratification, Mixing, Physical properties, Movement, Water properties, Runoff, Rainfall, Suspension, Silts, Chlorophyll, Light, Primary productivity.

Several mechanisms affect euphotic zone depth in Lindleyspoor Dam, South Africa: Sedimentation and turbid reservoir water dilution by less-turbid inflow waters increases photic zone depth; highly turbid water influx decreases photic zone depth; circulation processes increase and maintain photic zone depth. This weekly study May 1975 to May 1977 examined seasonal turbidity characteristics in a subtropical reservoir. Lindleyspoor Dam, with a 15.8 billion cu m volume, 175 ha area, and 22 m maximum depth, has a warm, monomictic thermal cycle (10.2-27.7C); southern hemispheric winter circulation occurs between May and August, while summer stratification occurs between August and April. During winter circulation periods, surface and bottom turbidity are equal. At this turbidity level, 50 JTU, secchi disc transparency is 0.2 m. After August temperature stratification, marked turbidity stratification is observed. In November, surface water turbidity decreases to 18 JTU, 0.8 m secchi disc transparency. In mid-December with the first spring rains, a flood increases bottom turbidity (60-310 JTU), but has little effect on surface water turbidity. A mid-January flood results in surface water turbidity increases (28-220 JTU) and 0.05 m secchi disc transparency. Turnover in May results in suspended material recirculation from bottom to the surface and establishes uniform turbidity profiles. No relationship exists between secchi disc transparency and chlorophyll, whereas a hyperbolic relationship exists between secchi disc transparency and turbidity. (Danovich-Wisconsin)
W80-01724

MAN-MADE STRESS PATTERNS IN TWO IMPOUNDMENTS,
Orange Free State Univ., Bloemfontain (South Africa). Inst. of Environmental Science.
D. F. Toerien, and R. D. Walmsley.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1690-1694. 1 Fig, 3 Tab, 8 Ref.

Descriptors: *Dams, *Water pollution sources, *Water quality, *Effluents, *Reservoirs, Impoundments, South Africa, Dewage, Sewage effluents, Agricultural runoff, Recreation, recreation wastes, Watersheds(Basins), Land use, Industrial wastes, Wastes, Land development, Eutrophication, Phytoplankton, Growth rates, Transparency, Roodeplant Dam(South Africa), Buffelspoort Dam(South Africa).

Monthly limnological data were collected March 1973 to April 1975 from two South African impoundments, Roodeplaat and Buffelspoort Dams, to evaluate water quality stress patterns induced by effluent disposal. Buffelspoort Dam water quality is fairly homogenous but increased catchment development might quickly result in detrimental changes. Roodeplaat Dam water quality is heterogenous with lowest water quality and highest phytoplankton growth closest to Pienaars River inflow and highest water quality and least phytoplankton growth near Edenvale Spruit inflow. Roodeplaat Dam with 42.1 million cu m volume and 10.6 m average depth, has a sinuous shape. Sewage effluents reach the dam by way of Pienaars, industrial effluents by way of Hartbees Spruit, while Edenvale Spruit drains agricultural lands, Significant parameter differences are observed in Roodeplaat Dam, indicating a severely stressed system. Pienaars River contributes minerals, large dissolved N and P quantities, and some dissolved organic substances. Recreational activities which are impeded by phytoplankton blooms and low water transparency should be zoned in areas other than Pienaars River. Hartvbees Spruit contributes minerals, probably from industrial effluents. Edenvale Spruit is an important organic pollution source. Buffelspoort Dam is smaller with 12.9 million cu m volume and 7.9 m average depth, and drains agricultural lands and a few holiday resorts. Parameters are higher, although not significantly so, closest to the main inflow. (Danovich-Wisconsin)
W80-01725

EFFECTS OF IMPOUNDMENTS ON RIVERS: AN AUSTRALIAN CASE STUDY,
Adelaide Univ., (Australia). Dept. of Zoology.
K. F. Walker, T. J. Hillman, and W. D. Williams.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Aggewandte Limnologie, Vol 20, 1978. p 1695-1701. 3 Fig, 1 Tab, 3 Ref.

Descriptors: *Impoundments, *Rivers, *Environmental effects, *Murray River(Australia), Australia, Reservoirs, Flow, temperature, Oxygen, Water properties, Water quality, Biological communities, Seasonal, Thermal stratification, Land development, fish, Physical properties, Adaptation, Oxygen sag, Succession, Competition, Invasion.

Environmental changes caused by water shortages were examined December 1973 to December 1976 in the Murray River, Australia. The river's water level is influenced by Lake Hume, a large reservoir built from 1936 to 1961. This paper comments on Lake Hume's effects on flow, temperature, oxygen regimes, and local fish fauna. Lake Hume has a 202.5 sq area, 3.07 million Mi volume and 15.2 m average depth. The impounded water is backed up along two river valleys, the Murray and Mitta Mitta. Releases from Lake Hume are governed by irrigation requirements in downstream areas. Regulation maintains higher than natural flows over the summer dry period. Seasonal temperature cycles occur in the Murray and Mitta Mitta rivers with mid-winter minimum, 6-7 C, and late summer maximum, 23-24C. Lake Hume affects seasonal thermal stratification; heat is stored in the lake. Temperature gradient is most pronounced near the dam and differential between top and bottom waters is maximum stratification at 3-8 C. A common thermal stratification side effect is for complete hypolimnetic oxygen depletion to occur causing an oxyagen sag to almost 100 km downstream. Two native species that have disappeared due to Lake Hume environmental changes are golden perch, Pectroplites ambiguus, and freshwater catfish, Tandanus tandanus. Several interoducted fish species, notably golden carp (Carassius auratus), redfin (Perca fluviatillis), tench (Tinca tinca), and trout (Salmo) are becoming increasingly dominant. (Danovich-Wisconsin)
W80-01726

STABILITY OF DIURNAL STRATIFICATION IN THE FORMING BROKOPONDO RESERVOIR IN SURINAME, SOUTH AMERICA,
Vrije Univ., Amsterdam (Netherlands). Biological Lab.
J. Van der Heide.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereiningung fur Theoretische und Angwandte Limnologie, Vol 20, 1978, p 1702-1709. 4 Fig, 12 Ref.

Descriptors: *Reservoirs, *South America, *Thermal stratification, *Tropic, *Water temperature, *Diurnal, *Lake Brokopondo(South America), Geographical regions, Stratification, Thermocline, Temperature, Environmental gradient, Hypolimnion, Oxygen, Heated water, Climatiz zones, Dry seasons, Lakes, Conductivity, Distribution, Depth, Stratification.

A diurnal cycle of temperature, oxygen content, and conductivity with depth was followed on May 15-16, 1964 at station Afobaka in Lake Brokopomdo, S. America, providing evidence that even slight tropical temperature gradients disclose definite stratification patterns if they are studied frequently and for long enough. Lake Brokopondo was formed by inundating a 1500 sq km tropical rain forest. Conditions near the dam have stabilized with differentiation appearing between oxygen containing epi/metalimnion and anoxic hypolimnion. Observations were made in the dry periods. Temperatures fluctuate (17-30C) in the top few meters, below which it remains almost constant and gradually decreases with depth. Oxygen curves follow temperature curves at corresponding depths very closely. The whole water mass below three meters is anoxic; and almost complete water deoxygenation occurs at dawn accompanied by an inverse temperature stratification in top layers. Surface oxygen levels rise to five mg/1 after sunset as a result of horizontal transports from less disturbed areas. Conductivity gradients confirm stratification stability in deeper layers. In spite of small temperature differences, corresponding density gradients are steep. Homothermal conditions are seldom observed, indicating that stratification is dynamic and interchange between layers occurs by turbulences and internal waves. In stratification terms, Lake Brokopondo is a small lake type. (Danovich-Wisconsin)
W80-01727

TEMPERATURE AND OXYGEN STRATIFICATION IN AMERICANA RESERVOIR, STATE OF SAO PAULO, BRAZIL,
Sao Paulo Univ. (Brazil). Dept. of Ecology.
C. G. Froehlich, M. S. Arcifa-Zago, and M. A. J. de Carvalho.
In: Proceedings: Congress in Denmark, 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1710-1719. 11 Fig, 2 Tab, 28 Ref.

Descriptors: *Water circulation, *Water temperature, *Thermal stratification, *Stratification, *Americana reservoir(Brazil), Temperature, Brazil, South America, Thermocline, Movement, Oxygen, Dissolved oxygen, Diurnal, Reservoirs, Seasonal, Lakes, Depth.

Temperature and dissolved oxygen measurements take from Americana Reservoir, Brazil, 1974-1976, show that this water body circulates fully at irregular intervals during the year ad therefore is polymictic. Thermal behavior is complex and has no definite seasonal pattern. STratification, while evident during sampling, seems unstable and short in duration. Differences in temperatures curves occur in samples taken a few hours apart. Thermoclines were seldom registered; however, temperature gradients are sufficient to maintain stratification, as evidenced by low DO bottom values. Dissolved oxygen curves generally follow temperature curves, but often with a steeper decrease. Superficial values vary 143.1% to 38.3%. saturation; bottom values 47.3% to 0.0% saturation. Diurnal surface warming on calm sunny days attains 3-7 m depth, independent of season; one surface temperature value reached 33C. During April to September cool months, Sao Paulo is subjected to Atlantic Polar Front cold air mass intrusions. Marked temperature drops greatly influence reservoir circulation and holomixis may occur. During October to March warm rainy seasons, stratification may be lost due to heavy rains cooling surface waters and increasing river discharge, with large flood volume consequent effects. Wind influence is not great in promoting total circulation since strong winds are absent in this region. (Danovich-Wisconsin)
W80-01728

VERTICAL MIGRATION OF DAPHNIA GESSNERI HERBST, 1967, IN AMERICANA RESERVOIR, STATE OF SAO PAULO, BRAZIL,
Sao Paulo Univ. (Brazil). Dept. of Ecology.
M. S. Arcifa-Zago.
In Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereiningung fur Theoretische und Aggewandte Limnologie, Vol 20, 1978, p 1720-1726 6 Fig, 17 Ref.

Descriptors: *Migration, *Animal behavior, *Daphnia, *Americana Reservoir(Brazil), Zooplankton, Reservoirs, Brazil, Migration patterns, Diel migration, Thermocline, Plankton, Crustaceans.

Four 48 hr vertical and horizontal samples were taken April, July, September, and December 1974 from Americana Resevoir, Brazil, to investigate occurrence of migration of Daphnia gessneri, a planktonic Cladoceran Species, and to find common environmental factors. Data should be viewed critically because of sampling errors. Vertical samples alone show that animals do not migrate; but horizontal samples demonstrate that zooplankton prefer superficial layers at night. Certain animal movements are fround in the water column, although not the entire population. Males and both young and adult females prefer the 0-6 m layer during day and night; young females are found in greater numbers 0-3 m. Behavior during one 24 hr period was not identical to the next 24 hr period. No seasonal pattern exists. Thermoclind (6-9 m in September) is a significant barrier to D. gessneri displacement. No clear relationship, exists between transparency and the depth where animals are distributed. Generally, D. gessneri behaves like many planktonic Cladocera in temperate lakes. (Danovich-Wisconsin)
W80-01729

DISSOLVED OXYGEN AND WATER TEMPERATURE STUDIES IN POOL NO. 2 OF THE UPPER MISSISSIPPI RIVER,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
H. Stefan, and W. S. Combs, Jr.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1744-1751. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Mississippi River, *Dissolved oxygen, *Water temperature, *Low flow, *Water circulation, Water levels, Minnesota, Temperature, Rivers, Mixing, Winds, Sewage, Flow, Photosynthesis, Effluents, Water quality, Sewage effluents, Bodies of water, Aeration, Oxygenation, Upper Mississippi River.

A 1976 study of upper Mississippi River water quality, including sewage effluents at St. Paul, Minnesota, under low flow conditions, demonstrated the significance of wind mixing and photosynthesis in recovering dissolved oxygen levels. In the summer of 1976, a severe drought occurred and upper Mississippi flow rates fell from normal 300 cu m s to 30 cu ms. This waste load allocation study extended 23 km from the waste treatment plant at St. Paul to Lock and Dam No. 2 at Hastings, Minnesota. An oxygen sag curve formed 3-14 km downstream from the sewage treatment plant outfall. Far upstream locations coincided with preceding hot sunny weather and southerly wind; far downstream conditions with preceding easterly wind and cloudy skies, two natural sources replenish dissolved oxygen; surface water re-aeration and photosynthesis. On a calm day with mean wind velocity 5.6 mph, 8/10 sky cover and one m mixing layer depth, net photosynthetic oxygen input is 7.3 g 02/sq m/d. Gravity, wind shear and buoyancy cause water motion and exchange. A drastic dissolved oxygen recovery from three to 13 mg 1 DO occurs in September at stations four miles apart due to buoyancy mechanisms in more shallow backwaters. These shallow backwaters and their long residence times produce strong dissolved oxygen and temperature variations. The system is complex due to highly unsteady vertical, lateral and longitudinal dissolved oxygen gradients. (Danovich-Wisconsin)
W80-01732

EFFECT OF A STREAM ELECTRIC GENERATING STATION ON THE EMERGENCY TIMING OF THE MAYFLY, HEXAGENIA BILINEATA (SAY),
Oak Ridge National Lab., TN.
J. C. Mattice, and L. L. Dye.
In Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereiningung fur Theoretische und Angewandte Limnologie, vol 20, 1978, p 1751-1758. 4 Fig, 1 Tab, 15 Ref.

Descriptors: *Environmental effects, *Heated water, *Mayflie, *Growth rates, *Electric powerplants, *Mature growth stage, *Kingston Steam Plant, Kingston, TN, Timing, Mathematical studies, Insects, Aquatic insects, Growth stages, Thermal pollution, Seasonal, Distribution, Water temperature, Waste water(Pollution), Tennessee, Effluents.

A June 1975-September 1976 study of emerging Hexagenia bilineata, a burrowing mayfly near Kingston Stem Plant, a nine-unit 1600 MW electric generating station, Tennessee, reveals that changes in emergence timing correlate well with water temperature. The mean day on which 50% of the mayflies had emerged was 29.6 days near heated water discharge outflow compared with 53.3 days at intake and 44.4 days at reference sites. June 1 is taken as day 1. The intake to discharge water temperature differential is 7.5 to 8.0C. Water temperature in the three areas follow typical seasonal temperate changes. Time order to median emergence is discharge, reference, and intake, following the same order as for mean temperatures. Emergence is intermittent June through August and generally occurs simultaneously in the three areas. Accelerated emergence near heated water plant discharges is not significant for whole reservoir mayfly populations. The combined study area equals less than 0.01% of the reservoir area. Environmental effects from Kingston plant operations on emergence patterns is thus localized. (Danovich-Wisconsin)
W80-01733

THE QUALITY OF GROUNDWATER IN CALIFORNIA,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 5B.
W80-01734

ENERGY BALANCE OF RUNNING WATER SYSTEM,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
W. Edelmann, and K. Wuhrmann.
In: Proceedings: Congress in Demark, 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1800-1805. 2 Fig, 4 Tab, 4 Ref.

Descriptors: *Algae, *Photosynthesis, *Energy budget, *Primary productivity, *Phototropism, Light, Light intensity, Biomass, Standing crops, Oxygen, Running waters, Growth rates, Plant growth, Energy, Energy equation, Mathematical studies, Productivity, Biological communities.

Experiments with three artificial outdoor channels confirm the Wuhrmann hypothesis that the ratio of radiant to chemical energy input into running water ecosystems correlates with phototrophic to heterotrophic biomass production rate proportion; phototrophic river biocenoses photosynthetic efficiency is also quantitatively measured. Growth rates, oxygen balances, and sociological conditions were observed 28 days in the channels; three and 1.5 mg sucrose 1 were added to channels 1 and 2, respectively, as an additional energy source. Mixed phototrophic/heterotrophic communities developed in channels 1 and 2 only phototrophs in channel 3. Phototrophic species composition is identical: dominant Tribonema minus, filamentous algae, and diatoms covering bottom surface. In channel 3, Achnantes and other diatoms grew over filamentous green algae. In channel 1 and 2, Sphaerotilus natans formed a considerable biocenosis part. A general rule could not be established for drift and standing crop increase ratio. Hetertrophic production is measured by phototrophic net production calculations from 02 data deducted from standing crop and drift increase. A second independent value is obtained from substrate sucrose consumption. Phototrophic energy balance was based on the photosynthesis equation; photosynthesis was inhibited by high light densities and quantum yields were elevated up to 0.12 02/quantum at low intensities. 85% of the energy fixed in biomass was leaving the system as microscopic drift. (Danovich-Wisconsin)
W80-01738

EFFECT OF HERBIVOROUS INSECTS ON THE PRODUCTION OF BENTHIC ALGAL VEGETATION IN OUTDOOR CHANNELS,
Eidgenoessische Anstalt fuer Wasservorsorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
E. Eichenberger, and A. Schlatter.
In: Proceedings: Congress in Denmark, 1977, Part 3; Internationale Vereinigung Fur Theoretische und Angewandte Limnologie, Vol 2l, 1978, p 1806-1810. 4 Fig, 1 Tab, 4 Ref.

Descriptors: *Algae, *Benthic flora, *Primay productivity, *Aquatic insects, Cyanophyta, Biological communities, Productivity, Biomass, Aquatic drift, Light, Light intensity, Photosynthesis, Herbivorous, Standing crops, Dominant organisms, Population, Ecology, Food chain, Predation.

A June-September 1976 study on herbivorous insect larvae effects on phototrophic benthos production patterns revealed changes in benthic species composition, loss in standing crops, and overgrazing problems. Initial vegetation development without aquatic insects produces filamentous algae and some diatoms followed by blue-greens such as Phormidium and Oscillatoria. Colonization production increases during the first month, stabilizes at five g odw/sq m/d and then drops to lower levels. As long as filamentous algae dominates, 30-60% of biomass is exported; once blue-greens are established, 5-10% is exported. In channels simultaneously exposed to insects and algae, no effect on standing crop accumulation is initially evident; however, grazing damage is apparent after seven weeks. Insects prevent blue-green community establishment. At grazing larval densities higher than 0.6 g odw/sq m/d, overgrazing is apparent; microphytic drift increases 5- to 7-fold, besides food egested, algal colonies appear in coarse drift fractions due to mechnaical vegetation damage. Production falls as standing crops are reduced to levels where nutrients and light are not optimally used. In colonies protected by herbivores for two months, blue-green vegetation grazing evolves with speed; average loss in standing crops is 4-5 g odw/sq m/d. Overgrazing might be a relatively frequent phenomenon masking productivity, especially where abruptly changing conditions upset ratios between herbivores and their predators. (Danovich-Wisconsin)
W80-01739

THE EFFECT OF DIMETHYL SULFATE ON THE REPRODUCTIVE SYSTEM OF THE LOACH, MISGURNUS FOSSILIS,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
For primary bibliographic entry see Field 5A.
W80-01743

SOME PROBLEMS IN FINDING GOOD STANDARDS FOR COOLING WATER,
KEMA N.V., Arnhem (Netherlands).
F. B. Koops.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978 p 1833-1836. 4 Ref.

Descriptors: *Water quality standards, *Cooling water, *Fish, *Plankton, *Environmental effects, *Heated water, Thermal stress, Entrainment, Mortality, Thermal powerplants, Water temperature, Regulation, Water policy, Water pollution, Stress, Mechanical equipment.

Studies on least possible ecological effects resulting from different quantities of discharged waste heat waters reveal that youngfish damage can be reduced by keeping temperature increases as high as possible and consequently cooling water quantities as low as possible; however, maximum permissible discharge temperatures (30 C) should not be exceeded. This literature survey concludes that decreasing cooling water quantities with resultant higher cooling water temperatures decreases total fish damage (thermal plus mechanical). Fish concentrate in warm outlet waters; however, increased temperature is not detremental. Damage does occur to larvae and juvenile fish entrained with cooling water and passing through the plant. Young fish entrainment is reduced when cooling water quantities decrease. With electric generation constant, this results in a proportional temperature increase. A maximum increase in discharge temperature to 34 C results in little phytoplankton damage and only minor damage to zooplankton with recovery in a few days. Detremental effects may increase on macro-invertebrates due to higher temperatures, however, diffusers near outlets would ensure rapid mixing. (Danovich-Wisconsin)
W80-01744

EFFECT OF HEXACHLORANE (HCCH) ON SOME HEMATOLOGICAL AND BIOCHEMICAL CHARACTERISTICS OF THE BLOOD OF THE ROUND GOBY (GOBIUS MELANOSTOMUS),
Odessa State Univ. (USSR).
For primary bibliographic entry see Field 5A.
W80-01745

MACROBENTHIC DIVERSITY AND ORGANIC POLLUTION IN THE ARCHIPELAGO OF ALAND (N BALTIC),
Abo Akademi Turku (Finalnd). Inst. of Biology.
For primary bibliographic entry see Field 5A.
W80-01748

NEW RESULTS ON PRIMARY PRODUCTION AND BIOGENIC AERATION IN GERMAN RIVERS,
Bundesanstalt fuer Gewasserkunde, Coblenz (Germany, F.R.).
D. Muller.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 1861-1866. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *West Germany, *Rivers, *Primary productivity, *Impoundments, *Energy budget, productivity, Seasonal, Oxygen, Phytoplankton, Light-dark bottle method, Dissolved oxygen, Photosynthetic oxygen, Photosynthesis, Water quality, Water pollution, Energy.

The order of increasing primary productivity of six West German rivers is Main (Steinheim Bend), Danube, Fulda, Rhine, Saar, and Moselle. Primary production measurements were performed on navigable German waterways to determine primary producer influences, such as secondary pollution effects and biogenic oxygen input, on constituent surface water budgets. Tewo methods were used: oxygen light/dark bottles and dissolved oxygen diurnal curves. In winter, production values hardly exceed measuring methods' error margins. In March, 4-5 g/sq m/d maximum values are reached. In summer, values higher than 20g/sq/m/d occur in some areas, but most values are below 14 g/sq m/s. In autumn, production decreases again to March values. In fair weather summer periods, 12 g/sq m/d for impounded rivers and nine g/sq m/d for free-flowing rivers are recommended for computing constituents budgets. With normal summer weather, values of five g/sq/ m/d or four g/sq m/ d, respectively, can be used. Moselle is an impounded, slow moving river; phytoplankton maximum density may already be reached before it enters German boundaries. Saar River is hydrogeographically and pollution-wise greatly diversified; most productivity values are below 10 g/sq m/d but considrerably higher extreme values occur in only slightly polluted areas. Main River values are relatively low; its waste water, by diminishing light and coprecipitating minerals, limits primary productivity. (Danovich-Wisconsin)
W80-01749

EFFECTS OF PRO-NOXFISH ON THE BENTHOS AND ZOOPLANKTON OF BUG LAKE, FOREST COUNTY, WISCONSIN,
Wisconsin Dept. of Natural Resources, Woodruff.
S. L. Serns.
Water Resources Bulletin, Vol 15, No 5, p 1385-1393, 1979. 1 Fig, 3 Tab, 22 Ref.

Descriptors: *Pesticide toxicity, *Zooplankton, *Benthic fauna, Rotenone, Diptera, Piscicides, Aquatic populations, Fish populations, Minnows, Sunfishes, Brook trout, Gastropods, Mortality, Daphnia, Copepods, *Pro-Noxfish, *Sulfoxide.

A concentration of 2.5 mg/1 Pro-Noxfish (0.063 mg/1 rotenone and 0.063 mg/1 sulfoxide) was applied to Bug Lake, Wisconsin, on November 17, 1975. There was an immediate toxicity to zooplankton and Chironomus. All taxa of benthic organisms and zooplankton that were present before toxicant application survived the treatment except for Pleuroxus denticulatus which was collected in only one sample before treatment. Comparable densities of benthic and zooplankton taxa were found on individual sampling dates before and after treatment; however, mean densities of trichopterans and dipterans were lower after treatment. The high variance in the sample along with the change in fish population after treatment are believed responsible for this indicated change in benthos density rather than the effects of the rotenone. (Deal-EIS)
W80-01750

CARBON BUDGET OF RIVERS AS EXEMPLIFIED BY THE DANUBE,
Bundesanstalt fuer Gewasserkunde Coblenz (Germany, F.R.).
T. Tittizer.
In: Proceedings: Congress in Denmark 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1873-1877. 5 Fig, 2 Ref.

Descriptors: *Carbon cycle, *Biochemistry, *Danube River(West Germany), *Self-purification, West Germany, Degradation(Decomposition), Carbon, Sewage, River, Flow, Water pollution, Carbonates, Carbon dioxide, Decomposing organic matter, Nutrient budgets, Waste assimilative capacity, Waste dilution, Water pollution effects, Organic compounds, Inorganic compounds.

Self-purification processes of the Danube River, West Germany, catabolize total organic carbon quantities equal to the sum of all organic carbon loads of the Danube's tributaries, the Altmuhl, Naab, Regen, Isar, Vils, Ilz, and Inn Rivers. Longitudinal profile examinations were carried out three years on the Danube River to determine waste water inflow effects on the processes. Various carbon forms, including TC, TIC, TOC, and DOC, and UOC were analyzed to determine degradability of various substances. The carbon budget is influenced by geology and anthropogenic substances. The Danube has a high inorganic carbon content, 45 mg/l, due to shell limestone and fossil coral reef formations in the drainage area. At 8.0-8.5 pH, inorganic carbon occurs mainly as hydrogen carbonate and carbonate ions. Carbon dioxide concentrations is negligibly low. Tributaries influence inorganic carbon level: the Isar River increases inorganic carbon whereas the Vils River has low lime content, decreasing inorganic carbon levels. Organic carbon results mainly from allochthonou-s pollution; downstream from heavy waste water inflows, organically-bound carbon concentration increases radically. Waste water from Regen and Naab tributaries increases total organic carbon content from 16 mg/l to 20 mg/l. Combining carbon and other water quality parameters (BOD), (COD), (TOD) provides valuable information for model computations, surface water recovery measures, and waste water load plains. (Danovich-Wisconsin)
W80-01751

ATTEMPTS TO REDUCE EUTROPHICATION IN AN ARTIFICIAL BATHING LAKE,
Technische Hochschule, Graz (Austria).
K. Stundl.
+n: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische Und Angewandte Limnologie, Vol 20, 1978. p 1878-1883, 5 Fig, 3 Ref.

Descriptors: *Eutrophication, *Sediments, *Artificial lakes, *Austria, *Nutrient removal, *Water pollution control, *Lake restoration, Nutrients, Phosphates, Water pollution, Detritus, Recreation, Beaches, Swimming, Sludge, Biomass, Phytoplankton, Zooplankton, Pollution abatement, Productivity, Water quality control.

Removing dead biomass from rich artificial lakes in Styria Province, Austria, provides the only means of controlling eutrophic tendendies of these bathing lakes. Lake Stubenberg, with a 45 ha area and eight m depth, is an example. After filling in 1971, eutrophication quickly set in and fish mortality rose. Peak bottom phosphate values in summer 1975 were 0.38 mg/1; ammonium was 7.0 mg/1. Sediments accumulated to 165 cu m/ha mazimum in 1975-1977. In order to prevent further eutrophication, the polluted feeder stream was diverted and river inflow was reduced, limiting nutrient inflow. Lake shallowness, however, promoted phytoplankton growth due to nutrient release from sediments. In 1975, the lake was emptied; sludge was cleared from bathing beaches and gravel was placed over the bottom. Sediment layers, which are continually deposited, are not drawn off with a suction sludge pump, reducing nutrient inflow. Bottom oxygen concentrations increased and in 1977, maximum transparency was 510 cm compared with 135-140 cm in previous summers. Primary production clearly decreased in 1976. Summer species consist of Cyanophyceae (Merismosedia teniussima, Microcystis flos-aque, and Aphanothece sp) and Chlorophyceae (Sphaerocystis). Crustacean density remains unchanged. Main rotifer species in 1976 are Kertella cochlearis, Polyarthra dolichoptera, and Conochilus unicornis. (Danovich-Wisconsin)
W80-01752

RELATION OF SAPROBIC TO TROPHIC LEVELS,
Prague Dept. of Water Technology and Environmental Engineering.
V. Sladecek.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1885-1889, 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Trophic level, *Biodegradation, *Microorganisms, *Saprobism, *Saprobity indes(S), *Degradation(Decomposition), Ecosystems, Productivity, Primary productivity, Plankton, Bacteria, Succession, Detritus, Decomposing organic matter, Biomass, Eutrophication, Phylogeny.

Saprobity and trophism are parallel limnological processes which sometines exhibit identical symptomatic characteristics and similar levels of intensity; however, the processes are factorially independent and must be studied separately in regard to their causes, effects and interrelationships. The index of saprobity (S) of communities of aquatic microorganisms represents the amount of putrescible organic matter and the intensity of its decompositon. Trophism is the extent and intenisty of organic primary production and its components can be quantitatively measured. Both phenomena occur together in surface waters, but only saprobism occurs in underground waters and in polluted waste waters. In this study a system is given by which trophism is shown in relation to saprobity. Data show that trophism as represented either by biomass (planktonic algae and chlorophyll) or by primary production of carbon per day or annually has a nearly hyperbolic function in regard to saprobity. In water bodies with a high degree of eutrophication, higher primary production is attained which is a supposition for qualitative changes within the communities according to progressive saprobic succession criteria. These findings contradict principles developed by Kolkwitz

(1935) which theorized synonymous saprovic and trophic levels for all waters. (Danovich-Wisconsin) W80-01753

SUCCESSION OF ORGANISMS IN THREE-STAGE SEWAGE PONDS,
Institute of Meteorology and Water Management, Krakow (Poland).
J. K. Pudo.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1891-1896, 1 Fig, 9 Ref.

Descriptors: *Succession, *Poland, *Biological communities, *Sewage lagoons, *Plankton, Sewage, Chlamydomonas, Chlorella, Phytoplankton, Zooplankton, Productivity, Biomass, Biochemical oxygen demand, Oxygen, Sewage treatment, Sewage bacteria, Settling basins, Seasonal, Rotifers, Sewerage, Microorganisms.

Biological investigations of sewage ponds in Alexandrowice near Cracow, Poland, July 1972 to July 1973 show great variability in biological composition and quantity depending upon the method of feeding sewage to the ponds, biochemical changes, and seasons. This paper examines effectiveness of domestic waste treatment ponds and organism succession. Sewage is generated by a population of 410 inhabitants and ranges 38-86 cu m/d. Sewage treatment includes three ponds: pond I is anaerobic for suspended sludge sedimentation; pond II is artifically aerated with compressed air by blowers; and pond III is an oxidizing, algal pond. Sewage normally flows through all three ponds, however, pond I is sometimes omitted. Two algal bloom periods occur in summer-autumn and spring seasons. Bloom forming organisms such as Chlaymydomonas and Chlorella vulgaris are present in all ponds; Cryptomonas erosa is present only in pond III. Rotifers are also numerous with Brachionus urceolaris, B. calyciflours and Epiphanes senta dominating. In pond I rotifers grow gradually and reach a maximum (32 ind/cu cm) when water blooms ind. BOD is relatively high, 100 mg/1, in late summer-autumn and decreases to 17-38 mg/1 in winter. Pond I diatoms, Hantzschia amphioxys and Nitzxchia hungaria, are characteristic of alpha-mesosaprobic waters. BOD in pond II oscillates between 20 and 70 mg/1; pond III BOD keeps mostly below 10 mg/1. (Danovich-Wisconsin) W80-01754

RATIO ATP/CHLOROPHYLL AS AN INDEX OF RIVERS' WATER QUALITY,
Instituto di Ricerca sulle Acque, Rome (Italy).
G. Chiaudani, and R. Pagnotta.
In: Proceedings: Congress in Denmark 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1897-1901. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Systematics, *Water quality, *Chlorophyll, *Tiber River(Italy), Water pollution, Chemical properties, Biochemical oxygen demand, Oxygen, Rivers, Italy, Organic matter, Organic loading, Organic wastes, Degradation(Decomposition), Waste assimilative capacity, Ammonium compounds.

This September 1975 to April 1976 study of a segment of the lower Tiber River, Italy, confirms that ATP/chlorophyll (Ch) ratios are useful for rapidly detecting water quality shifts in rivers where eutrophication or organic wastes are involved. The ATP/Ch method more accurately assesses water quality than biomass-chlorophyll ratios. Water quality is classified by the burden of organic, biologically decomposable substances; low to moderate, moderate to critical, and severly polluted. Main chemical parameters used as references are COD, ammonium content, and oxygen content. ATP/Ch ratio increases with ammonium concentration and COD while DO decreases with relation to increased organic load. Correlation coefficients are all highly significant for chemical parameters and mean ATP/Ch. In free-flowing rivers, ATP/Ch ratios (x 100) less than 10 indicate low to moderate pollution. Moderate to critical pollution is characterized by a ratio of 10-20. Severely polluted rivers have ATP/Ch ratios greater than 20. In cultured algae, values less than 10 characterize autotrophic conditions; with values more than 20, heterotrophic organisms prevail. Values ranging 10-20 indicate a succession of autotrophic conditions; with values more than 20, heterotrophic organisms prevail. Values ranging 10-20 indicate a succession of autotrophic towards heterotrophic conditions. (Danovich-Wisconsin) W80-01755

COMPLEX SIMULTANEOUS ANALYSIS OF THE SAVA RIVER AT DIFFERENT HYDROLOGICAL CONDITIONS,
Hydrometeorological Inst. of Croatia, Zagreb (Yugoslavia).
N. Sostaric, B. Stilinovic, Z. Paveltic, and I. Matonickin.
In: Proceedings; Congress in Denamrk 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie. Vol 10, 1978, p 1902-1909.

Descriptors: *Sava River(Yugoslavia), *Waves(Water), *Dynamic programming, *Hydrologic aspects, *Rainfall, *Self-purification, *Streamflow, Yugoslavia, Phytoplankton, Zooplankton, Streams, Rivers, Bacteria, Currents(Water), Graphical analysis, Mathematical studies, Probability, Hydrograph analysis, Seston, Water pollution.

Simultaneous analysis of a single dynamic water volume during its course along a selected reach of the Sava River, Yugoslavia, with deterministic (on the reach) and statistic (on the profile) parameters was used to develop self-purification constants and coefficients for the river. The selected reach is 208.4 km long; it starts in mountains and levels off to a lowland watercourse. Rainfall and travelling wave effects on water parametets were observed. Rainy weather and river waves prevailed during the first simultaneous analysis in September 1976; during October 1976, stable weather with moderate rainfall in lowland areas occurred. Significant changes in suspended solids and KMn04 oxidability are caused by rainfall and the traveling wave. Relatively small increases in Ca, K, and Na content are caused by groundwater. Phytoplankton and zooplankton were determined; Sphaerotilis dominates. Other phytoseston groups include Cyanophyta (Lyngbya, Phoridium), Diatomae (Nitzchia, Synedra), and Rhodophyta (Chantransia). Zooseston include Cilliata such as Aspidisca lynceus and Carchesium polypinum and Flagellata. Tributaries such as the Zagreb, which is heavily polluted, increase Sava River biomass 5.75 times values immediately upstream. Bacteria decay coefficients show that increasing pollution causes (1) faster removal of heterotrophic and proteolytic bacteria, P-mineralizing bacteria, Escheri coli, and bacterial biomass, and (2) slower removal of nitrate-reducing bacteria, ammonifying bacteria and H2S-producing bacteria. (Danovich-Wisconsin) W80-01756

SUCCESSION OF PHYTO- AND ZOOPLANKTON IN A WASTEWATER STORAGE RESERVOIR,
Mekorot Water Co., Tel Aviv (Israel).
J. Eren.
In: Proceedings: Congress in Denamrk 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1926-1929.

Descriptors: *Phytoplankton, *Zooplankton, *Reservoirs, *Irrigation, *Water reuse, *Kfar Hasidim Reservoir(Israel).

Since Israel uses almost all its water resources, storage reservoirs filled with sewage effluent are being used for irrigation without causing environmental nuisances. Kfar Hasidim reservoir in northern Israel has an 8 ha area and average 6.5 m depth when full. Secondary treated effluents from Haifa sewage treatment plant were pumped into the reservoir during March; at the end of August only 1 m of water remained in the reservoir. The study investigated chemical and biological changes in the four month period. The reservoir contained 2.5 mg/1 dissolved oxygen during the storage period. BOD decreased from 60 to 9 mg/1 and COD from 230 to 118 mg/1 from Haifa sewage treatment plant to the reservoir, respectively. However undesirable odors were not recorded around the reservoir. After initial dense populations of Chlamydomonas and Euglena, algal density declines due to intense zooplankton grazing. Herbivorous zooplankton consist mainly of Daphnia and Brachinous and reach 780 ind/1 and 13,000 ind/1, respectively, in June. Algal biomass, mostly Ankistrodesmus, is 1-2 mg Dwt/1 during irrigation season. In August zooplankton decrease followed by a secondary algal bloom dominated first by Euglena and later by Spirulina. Secchi transparecney is 25 cm in April, 180-250 cm during June-July and only 10 cm in September. (Danovich-Wisconsin) W80-01758

THE EFFECTS OF CHLORINE, ELEVATED TEMPERATURE AND EXPOSURE DURATION OF POWER PLANT EFFLUENTS ON LARVAL WHITE PERCH MORONE AMERICANA (GMELIN),
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
For primary bibliographic entry see Field 5A.
W80-01759

MOBILIZATION OF METALS FROM SEDIMENT BY NTA,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
H. E. Allen, and C. Boonlayangoor.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 1956-1962. 3 Fig, 11 Ref.

Descriptors: *Nitrilotriacetic acid, *Iron, *Sediments, *Chelation, *Chemical reactions, *Detergents, Metals, Chemicals, Copper, Nickel, Lead, Zinc, Water quality, Sewage effluents, Chemical wastes, Rivers, Sediment-water interfaces, Sewage treatment, Activated sludge, Suspended solids.

This laboratory study of US and European River sediment and water samples mixed with 0.05, 0.20, 0.75, 3.5, and 10.0 mg/1 H3NTA, concludes that NTA (trisodium salt of nitrilotriacetic acid) when used as a builder replacing phosphates in detergents, results in little or non-detectable metal mobilization from sediments. NTA concentrations extend from those typical of receiving waters to levels above environmental concentrations. Data from experiments using 100 g sediment/1 overestimate natural environment mobilization by tenfold and thereafter mobilized trace metals and phosphate concentrations typical of environmental conditions, iron is not mobilized or mobilized to only a slight extent. NTA peptizes colloidal ferric hydroxide which retards aggreagtion and allows iron to pass through 0.45 micro m membrane filters. Effluent from Canadian activated sludge sewage treatment plants contains 0.75 mg MTA/1; at this concentration metal mobilization occurred for copper in one sample, nickel in two samples, and zinc in one sample. Soluble NTA resulting from this concentration probably causes metal concentration increases of 10% or less. Diluting NTA to one-fourth that present in Canadian activated sludge sewage treatment plant effluents would probably result in metal concentration increases too small to be measured. (Danovich-Wisconsin) W80-01762

DIET OF BROOK TROUT (SALVELINUS FINTINALIS MITCHELL) AND BROWN TROUT (SALMO TRUTTA L.) IN AN ALPINE STREAM,
Maryland Univ., College Park, Dept. of Zoology.
D. J. Allan.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 2045-2050, 1 Fig, 3 Tab, 9 Ref.

Descriptors: *Brown trout, *Brook trout, *Cement Creek(CO), *Fish diets, Fish food organisms, Foods, Diets, Mountains, Benthic fauna, Inverte-

brates, Population, Salmonids, Colorado, Aquatic drift, Predation, Diptera, Mayflies, Size, Larvae, Aquatic insects, Diurnal.

Salmonids, brook trout Salvelinus fontinalis and brown trout Salmo trutta, studied in Cement Creek, Colorado 5-6 August 1975, have similar food preferences; they feed most heavily on the most abundant prey and large size prey. The study compares prey eaten by brown trout to invertebrate abundance in drift and benthos. Cement Creek is a high elevation (3600-2602 m), stony bottom stream. Drift during the night exceeds drift during the day. Ephemeroptera nymphs and Diptera larvae dominate, together account for over 80% total drift. Ephemeroptera are the most abundant benthos. Both trout species consume most invertebrate taxa present in the stream. Prey number per trout are greatest in afternoon and evening hours, but some prey are observed in stomachs throughout the 24 h period. Ephemeroptera are less frequent in trout stomachs (20.4% day) and 40.5% night) for brook trout and 36.2% (day) and 66.7% (night) for brown trout than expected from drift (62.5%) and benthos (73.0%) frequency. Diptera larvae, emerging aquatic insects, and terrestrial items are more frequent in trout stomachs than in drift orbenthos. Brown trout differs from brook trout in consuming more Ephemeroptera and fewer Diptera; brown trout also prefer certain taxa which are relatively large but rare including Ephemerella, Rhithrogena, and Rhyacophila species. Larger nymphs of mayfly Baetis bicaudatus are much more heavily fed upon by trout than smaller nymphs. (Danovich-Wisconsin)
W80-01770

RISE AND COLLAPSE OF AN INTRODUCED FISH, MORNONE MISSISSIPPIENSIS IN CLEAR LAKE, IOWA,
Iowa State Univ., Ames. Dept of Animal Ecology.
K. D. Carlander.
In: Proceedings: Congress in Denmark 1977. Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 2051-2054, 4 Fig, 12 Ref.

Descriptors: *Yellow bass, *Clear Lake(IA), *Fish populations, *Fish populations, *Fish establishment, *Water level fluctuations, Size, Fish reproduction, Fish harvest, Growth rates, Competition, Droughts, Stress, Yellow perch, Freshwater fish, Bullheads, Sunfishes, Fisheries, *Iowa.

Per-day catch of average yellow bass, Morone mississippiensis, increased from 14 in 1947 to 26 in 1949 in Clear Lake, Iowa; catch was 54 and 65 per net-day from 1954-1959 (drought years) but increased to 114 in 1976. Aeromonas salmonicida almost eliminated yellow bass population in 1968 but since that time, the popylation has been slowly increasing. Clear Lake is a 1474 ha eutrophic lake with 6 m maximum depth and yellow bass were introduced 1930. In the late 1950s drought lake area shrank 8%. Beach seine samples indicate good yellow bass reproduction in 1950, 1951, 1954, 1956, 1965, and 1967. Year class strength is not correlated with reproductive success. MAximum sizes (from 290-190 mm) and growth decreased markedly in the 1940s and 1950s when yellow bass were the most abudnant lake species. When water levels increased after the drought, growth rate increased somewhat, but population density was still high. After reduction by epizootic, sizes and growth rates increased to levels similar to early 1940s. Yellow perch is most directly affected by yellow bass competion. Since 1947, yellow perch have not been abudnant and few were over 180 mm total length. However, perch catches in 1973 and 1974 are similar to those of yellow bass in mid 1960s. Perch increase did not immediately follow upon yellow bass decline. Black crappies and black bullheads both had successful year classes in 1968-1971. However, yellow perch growth rate increased immediately after the sharp decline in yellow bass numbers. (Danovich-Wisconsin)
W80-01771

FEEDING BEHAVIOR AND TERRESTRIAL LOCOMOTION IN THE CYPRINODONTID FISH, RIVULUS HARTII (BOULENGER),
University of Western Ontario, London. Dept. of Zoology.
For primary bibliographic entry see Field 8I.
W80-01772

EFFECT OF FISH (SALVELINUS ALPINUS, ARCTIC CHAR) PREDATION ON THE ZOOPLANKTON IN TEN NORWEGIAN LAKES,
Trondheim Univ. (Norway). Museum.
A. Langeland.
In: Proceedings: Congress in Denmark 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 2065-2069. 3 Fig, 16 Ref.

Descriptors: *Norway, *Lakes, *Zooplankton, *Fish food organisms, *Arctic char, *Daphnia, *Predation, Fish, Fish diets, Size, Weight, Invertebrates, Salmonids, Crustaceans, Benthic fauna, Aquatic insects, Population, Competition, Fisheries.

High densities of Arctic char have profound predation effects on the largest zooplankton species, Bythotrephes longimanus and Daphnia galeata, in 10 Norwegian lakes; the fish also affects prey species size. The lakes, with 0.4 to 58 sq km surface areas and 15 to 204 maximum depths, are situated in Trondelag, Central Norway. Arctic char prefer Cladocernas rather than Copepods and main prey species inclde Daphnia galeata, Bythotrephes longimanus, Bosmina longispina. and holopedium gibberum. Stomach contents also include benthic invertebrates and surface-caught insects. D. galeata is the most important prey species; it ranges 0-75% zooplankton biomass in the 10 lakes and is most abundant (800-7000 per cu m) in the five lakes with highest arctic char mean weights. High char densities cause low D. galeata densities; predation also explains B. longimanus absence. B. longimanus has been completely eliminated in some lakes due to predation. Where D. galeata densities are less than 0.2-0.8 ind/1, the zooplankton are no longer available as food for a arctic char and D. cristata, a smaller species, replaces it. In lakes with highest predation pressure, mean adult D. galeata size also decreases. B. longispina displays an opposite pattern from D. galeata and B. longimanus, with higher predation densities and relatively greater importance as food in lakes with lowest mean arctic char weight. (Danovich-Wisconsin)
W80-01773

REMARKABLE YIELD OF BROWN TROUT (SALMO TRUTTA L.) IN LAKES NEAR THE HARDANGER GLACIER, NORWAY,
Trondheim Univ. (Norway). Museum.
J. W. Jensen.
In: Proceedings: Congress in Denmark 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20 1978, p 2070-2075. 1 Fig, 4 Tab, 14 Ref.

Descriptors: *Brown trout, *Fish populations, *Hardanger glacier(Norway), *Growth rates, *Oligotrophy, Population, Norway, Lakes, Water chemistry, Melt water, Glaciers, Snowmelt, Biological communities, Salmonids, Fish food organisms, Fish diets, Fish harvest, Fishing, Fish establishment, Fish physiology, Crustaceans, Plankton, Fisheries.

Surveys in 1975-1976 of 20 lakes in Hardanger, Norway reveal total catches of 709 brown trout (Salmo trutta L.), the only fish species in these lakes. Hardanger glacier in southern Norway, is 95 sq km and the fifth largest in Norway; its lakes lie between 832 and 1348 m a.s.1. in three different river systems and range 5-250 ha. Water has extremely low ionic contents, 5.5-5.7 pH, and 0.5-20 m Secchi depth. Five crustacean species occur: Eubosmina longispina and Cyclops Scutifer dominate. In river system 1, trout catches vary from 633 to 1715 g. In the main course of river system 2, only three fish were taken. Lake 2a, in a tributary, yields 2337 g. Lake 3a yields 1618 g and 3b, 720 g. Eight lakes have no fish. Lowest altitude lakes show 4.6-5.4 annual trout growth, the highest in the river systems. Some 30% of the trout weigh more than 300 g. River system 1 trout with two months open water and 5-8 C temperatures, grow 4.0-4.6 cm in dense populations; these season growth rates are more than twice normal values. All physical and chemical conditions show minor primary production; macrophytes do not even occur. Trout apparently exploit all available food sources; stomachs contain relatively few prey. In lake 3b, annual yield is estimated at 4 kg/ha. Long periods with 0.5 m Secchi depth cause negligible primary productivity; fish production is probably entirely based on allochthonous material. (Danovich-Wisconsin)
W80-01774

EVALUATION OF THE CRITICAL THERMAL MAXIMUM FOR DETERMINING THERMAL TOLERANCE OF FRESHWATER FISH,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5A.
W80-01775

VERTICAL DISTRIBUTION OF FISHES IN ONE LAKE DEEP (LAKE KUUSVESI, CENTRAL FINLAND),
Jyvaskyla Univ. (Finland). Dept. of Hydrobiology.
P. Eloranta, and A. Eloranta.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 2092-2097. 6.Fig, 2 Tab, 2 Ref.

Descriptors: *Lake Kuusvesi(Finland), *Fish migration, *Vertical migration, *Seasonal, *Oligotrophy, Fish, Distribution, Distribution, Distribution patterns, Ecological distribution, Depth, Fish populations, Perches, Sunfishes, Killifishes, Bottom fish, Testing procedures, Fish harvest, Fisheries, *Finland.

Results of vertical fishing compared to normal test fishing during summer and autum 1976 in oligotrophic Lake Kuusvesi, central Finland, show fish movement from shallow littoral waters to deep waters in autumn. Lake Kuusvesi has 3.7 m mean depth and 6.9 pH. Most abundant fish species includes roach (Rutilus rutilus), perch (Perca fluviatilis), bream (Abramis brama), white bream (Blicca bjoerkna), ruffe (Acerina cernua), and bleak (Alburnus alburnus). Total catch during vertical fishing was 7,677 fish including perch 35.2%, mean weight (mwt) 25.3 g; roach 31.9%, mwt 37.0 g; white bream 11.4% mwt 18.0 g; vendace 10%, mwt 30.6 g; ruffe 8.7%, mwt 9.7 g; and six other species. July mean catch/net/d (all nets) was 5.0 with surficial nets having highest individual mean value, 12.7 fish. August mean catch/net/d (all nets) was 6.3 with bottom nets having highest individual mean value, 15.0 fish. Autumn mean catch in vertical nets was higher than summer values, being 52.2/net/d, with bottom nets having highest individual mean catch, 122.1 fish. Perch occur abundantly in warm surface waters in summer and move to deeper bottom waters in autum. Roach are evenly distributed. Ruffe, white bream, burbot, and bream inhabit bottom water layers during the entire study period. During summer, catch/net/d for normal fish testing is 4.5 to 7.4 times vertical net catches. In autumn, catch/net/d of vertical nets is twice that of test fishing, making it difficult to obtain correct proportions of different fish species. (Danovich-Wisconsin)
W80-01777

TOXICITY AND BIOCONCENTRATION OF EPN AND LEPTOPHOS TO SELECTED ESTUARINE ANIMALS,
Environmental Research Lab., Guld Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-01778

POPULATION STUDIES OF VENDACE (COREGONUS ALBULA (L.) AND PERCH (PERCA FLUVIATILIS L.) IN A MESOHUMIC OLIGOTROPHIC LAKE,
Joensuu Univ. (Finland). Karelian Inst.
M. Viljanen.
In: Proceedings: Congress in Demark 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20 1978, p 2103-2110. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Fish populations, *Perches, *Salmonids, *Analytical techniques, *Lake Suomunjarvi(Finland), Fish, Biomass, Distribution, Finland, Scuba diving, Marking techniques, Capture-mark-and-recapture technique, Nets, Dominant organisms, Growth stges, Age, Fish harvest, Number fish per acre, Density, Oligotrophy, Fisheries.

The most important findings of density and population biomass studes of vendance (Coregonus albula) and perch (Perca fluviatilis) in Lake Suomunjarvi, eastern Finland, 1974-1977 are the large perch population fluctuation in Lapinlathi Bay, similarity of diving results at different sites and different years, and similarity of population estimates by scuba diving and mark-recapture methods. Analytical techniques include a combinations of mark-recapture and scuba diving with regard to perch, and mark-recapture and seining-area method with regard to vendace. Suomunjarvi is a mesohumic oligotrophic lake with 650 ha area, 5.7 mean depth, and 27 m maximum depth. Most numerous fish species are vendance (31% of biomass), perch (26.5%) and whitefish (14.1%). in 1975-1977, 46,502 (1+) and 3,450 (>or=2+) total vendance were caught, 9,109 (1+) and 897 (>or =2+) were marked and released, and 182 (1+) and 42 (>or =2+) marked fish were recaptured. Density fluctuated 520-3,290 (1+) and 148-187 ind/ha (>or =2+) and biomass 7.9-19-4 (1+) and 5.3-6.7 kg/ha (>or =2+) depending on year, lake area, and method. Mean vendace catch for 1974-1976 was 1.6 kg/ha/yr. Both mark-recapture and scuba diving methods give almost identical perch results. Mark-recapture experiments (1975-1976) in Lapinlahti Bay show 2,058 perch (>or =2;) caught, 1,994 marked and relesed, and 336 marked fish recaptured. Perch population in Lapinlahti Bay in 1975 were 3,560 or 224 ind/ha and in 1976, 910 or 57 ind/ha. Biomass was 8850 kg or 13.6 kg/ha. (Danovich-Wisconsin)
W80-01779

PETROLEUM IN DEEP BENTHIC ECOSYSTEMS OF THE GULF OF MEXICO AND CARIBBEAN SEA,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W80-01780

IMPOUNDMENTS AND THEIR INFLUENCE ON THE RIVERS STUDIED BY BIOASSAYS,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
M. Bombowna, H. Bucka, and W. Huk.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, p 1629-1633, 1978. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Bioassay, *Eutrophication, *Reservoirs, *Poland, Impoundments, Algae, Diatoms, Water pollution sources, Growth rates, Population, Curves, Phosphates, Nitrates, Nutrients, Nutrients loading, Mathematical studies, Equation, Environmental effects, Primary productivity.

Water flowing in and out of the Goczalkowice, Roznow, and Tresna reservoirs in Poland showed higher eutrophication levels than the Solina impoundment in 1973-74. Carpathian Mountain rivers drain one-tenth of Poland; however, their impoundments supply over 30% of total water resources. Agricultural wastes are the primary cause of eutrophication, with municipal and industrial waste effects secondary. In spring the greatest leads flow into the impoundments. Phosphates are the limiting factor with nitrates in excess. Diatoms such as Cyabella ventricosa, Cyclotella, Navicula, and Diatoma vulgare are dominant, with lesser quantitites of green algae, blue-green algae, and chrysophytes. The greatest fertility is in Goczalkowice impoundment. Green algae are more numerous above impoundments; whereas diatoms grow better below impoundments. Chlorophyll-a content in the green algae; diatoms ratio is 83:38 above impoundments and 71:44 micro g l below them. Above impoundments, primary production is 0.82 for green algae and 0.40 mg 02 1 h for diatoms, below impoundments, 0.45 and 0.83 mg 01 1 h, respectively. One positive effect of these impoundments is the decreased number of green algae below impoundments with better diatom development; therefore, impoundments enhance microorganism succession typical for mountain rivers. (Danovich-Wisconsin)
W80-01781

RELATIONSHIPS AMONG BIOLOGICAL AND PHYSIOCHEMICAL PARAMETERS IN SPANISH RESERVOIRS,
Instituto de Investigaciones Pesqueras, Barcelona (Spain).
M. Estrada.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978. p 1642-1646. 4 Fig, 5 Ref.

Descriptors: *Reservoirs, *Physicochemical properties, *Water chemistry, *Geographical regions, *Spain, Chemical properties, Mathematical studies, Nitrates, Phosphates, Biological properties, Water properties, Water types, Hardness, Silica, Chlorophyll, Lentic environment, Geologic control, Mineral water, Impoundments.

Relationships of water quality parameters in 100 Spanish reservoirs explain general phenomena; however, on a more localized scale relationships vary enough to require that individual species of organizms in each reservoir must be separately considered. Four surveys 1972-1975 sought data on p!ant pigments and physiochemistry. principal components for stratification and mixing data are water mineralization and biological activity. The geograhical distribution of the latter component shows some regularities but these are difficult to interpret. Reservoir waters in northwest and western Spain have low mineral content due to siliceous rocks; central and eastern Spanish reservoirs have high mineral content because soluble limestones are abundant. Alkalinity and chlorophyll relationships are not simple; chlorophyll content is low in extremely soft water reservoirs, but increases with alkalinity only up to intermediate ranges one meg l. Phytoplankton photosynthetic activity plays a major role in CaC03 precipitation, by depleting C02 and elevating pH values. Nitrate concentrations are higher in more-mineralized eastern Spanish reservoirs; however, phosphate concentrations are lower because its precipitation is more intense. Chlorophyll content during stratification periods, when algal growth is more active correlates significantly with phosphate concentration, suggesting its importance in controlling phytoplankton biomass. (Danovich-Wisconsin)
W80-01782

ZOOPLANKTON CRUSTACEANS IN SPANISH RESERVOIRS,
Barcelona Univ. (Spain). Dept of Ecologia.
J. Armengol.
In: Proceedings: Congress in Denmark 1977, Part 3: Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20 1978. p 1652-1656, 2 Fig, 1 Tab, 1 Ref.

Descriptors: *Reservoirs, *Zooplankton, *Classification, *Trophic level, *Correlation analysis, *Spain, Crustacean, Copepods, Invertebrates, Speciation, Variability, Mathematical studies, Graphical analysis, Curves, Ecosystems, Eutrophication, Mestrophy, Oligotrophy, Impoundments.

Principal coordinates and similarity matrices were used to analyze zooplankton crustaceans in relation to reservoir classifications in 104 Spanish reservoirs. Although analytical results are inconclusive, axes are well correlated with species distribution and reservoir classifications established by Margalef and Estrada. The first axis correlates perfectly with species abundance; the second axis relates to parameters regarding water mineralization; the third axis is associated with parameters indicating trophic levels. The second and third axes form species classification according to principal environmental characteristics. Five groups were established. Group I includes the commonest species such as Bosmina longirostria, Ceriodaphnia pulchella, Diaphanosma brachyurum, and Daphnia longispina, and does not have very defined environmental preferences. Group II, characterized by heavily mineralized waters and moderate eutrophy, comprises Daphnia magna, Lovenula alluadi, and Ceriodaphnia reticulata. Group III includes Daphnia parvula and Copidiaptomus steueri species in mineralized and eutrophic waters. Groups IV and V correspond to reservoirs with acid waters; the fourth is most eutrophic and formed by Thermocyclops dybowskii plus Alona quadragularis and Paracyclops fimbriatus. The fifth corresponds to moderately eutrophic reservoirs in which Diatomus castaneti, Megacyclops viridis, and Eurycercus lamellatus appear. (Danovich-Wisconsin)
W80-01783

HISTORICAL AND ECOLOGICAL FACTORS CONCURRING IN THE DISTRIBUTION, BIOMETRY AND FERTILITY OF PLANKTONIC CRUSTACEANS IN PYRENEAN LAKES,
Barcelona Univ. (Spain). Dept. of Ecologia.
M. R. Miracle.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1657-1663. 1 Fig, 2 Tab, 19 Ref.

Descriptors: *Lakes, *Crustaceans, *Zooplankton, *Population, *Distribution, *Pyrenees, Spain, Invertebrates, Plankton, Copepods, Physicochemical properties, Trophic level, Water properties, Biological communities, Fertility, Standing crops, Primary productivity, Pyrenees mountains, Distribution patterns, Ecological distribution, Habitats, Environmental effects.

This July-August 1974 study of 50 lakes in the eastern half of the Spanish Pyrenees Mountains includes that distribution, morphometry, and biology of planktonic crustacea cannot be explained solely by alkalinity, temperature, trophic state, and fish predation factors; water flux, stability, size, and environmental isolation must also be considered. Crustacean species composition is uniform with Cyclops abyssorum and Daphnia longispina occurring in most lakes. Among euplanktonic species, five community types are found: (1) without diaptomids; (2) with small diaptomids; (3) with bigger diaptomids; (4) with two different size diaptomids; and (5) astatic waters with anostracan. Areas, depths, trophic levels and salmoid presence have wide ranges for lakes. Alkalinity does account for vicarious diaptomid distributions. E. vulgaris occurs in 0.04-1.2 meq 1 alkalinities whereas M. laciniatus does not occur in alkaline waters. Genus Diaptomus occurs only in Pyrenean lakes and not in Alpine or other European lakes. Copepods show important size and fertility differences as adaptations to ecological conditions. Temperature clearly affects C. abyssorum size; however, diaptomids are independent of this factor. Trophic level affects size variablity in both copepod groups. Body length variance corresponds with Secchi disc and chlorophyll contents. Relations between male abundance and size exist in C. abyssorum populations. Water flux also influences fertility. (Danovich-Wisconsin)
W80-01784

COMPOSITION AND DYNAMICS OF ZOOPLANKTON IN THE SAVA LAKE,
Institute for Biological Research, Belgrad (Yugoslavia).
V. Kalafatic.
In: Proceedings: Congress in Denmark 1977, Part 3: Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1664-1666, 1 Fig, 1 Tab.

Descriptors: *Zooplankton, *Productivity, *Copepods, *Ecological distribution, *Larvae, *Sava Lake(Yugoslavia), Yugoslavia, Secondary productivity, Biomass, Standing crops, Lakes, Seasonal, Larval growth stage, Rotifiers, Daphnia, Aquatic life, Plankton, Invertebrates.

Zooplankton of Sava Lake, Yugoslavia are the Cladocera-Copepoda type, characterized by high production and remarkable species dynamics; how-

ever, the most diversified group are Rotatoria, which includes 59% of all recorded species. This 1974 study examined zooplankton structure and dynamics in relation to ecological factors. Damming up the Sava River, principal tributary of the Danube, forms Sava Lake, four km in length, 80 m wide, and 12 m maximum depth. Bosmina longirostris, B. coregoni Daphnia cucculata, and D. longispina are characteristic Cladocera species exhibiting high population density in spring and summer. Bosmina coregoni coregoni is a rare and scattered species which normally prefers large water bodies. It reaches Sava Lake in September with 20.9 ind 1, becoming the dominant zooplankton species. Seven Copepoda species make up 15% of total zooplankton species. Eudiaptomus gracilis is the only diaptomid recorded. In the one-year investigation, two vernal and one aestival zooplankton production peaks occurred. First peak occurred in March and amounted 36.6 ind 1. Larval Copepoda stages averaged 27.7 ind 1. Zooplankton production in May reached 51.0 ind 1. The third peak occurred in August and amounted 27.3 ind 1. Minimum zooplankton numbers were recorded in winter and averaged 5.2 ind 1 in October. Larval Copepoda stages are particularly important with production peaks corresponding to peak larval Copepoda numbers. (Danovich-Wisconsin)
W80-01785

SEDIMENTATION PROCESS ABOVE THE ASWAN HIGH DAM IN LAKE NASSER-NUBIA (EGYPT-SUDAN),
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
B. Entz.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte, Limnologie, Vol 20, 1978, p 1667-1671. 6 Fig, 6 Ref.

Descriptors: *Dams, *Sedimentation, *Deposition(Sediments), *Environmental effects, *Aswan High Dam, Impoudments, Egypt, Nile River, Floods, Lakes, Sediment rates, Sediment distribution, Reservoir silting, Sediment discharge, Water levels, Flutuations, Flow, Biological communities, Indicators, Africa.

If Sedimentation continues unidisturbed, Lake Nasser, formed by the Aswan High Dam, Egypt, would not be completely filled for 1700 years; however, strong water level fluctuations and floods could markedly reduce filling time. This 1973 echo-sounding study investigated depths of new sediments. No durable deposits have been formed previously in the swift Nile River; however, as soon as the river widens, at 390 km form the dam, sedimentation starts immediately. Sedimentation occurred between 420 and 290 km with its peak at 350 km where the narrow semi-riverine section widens to 4-10 km wide forming a long lacustrine section near Wadi Halfa. Sedimentation between 400 and 356 km takes place at the old channel edge, decreasing gradually towards shore. Sedimentation under lacustrine circumstances is quite different (356-310 km). The old river bed is completely filled with new sediments, forming a smooth and almost horizontal silty bottom. Reservoir filling by mud will not be complete where main currents pass. A channel 10 to 12 m deep, as usual on riverine Nile sections, will be maintained. The New Nile will flow between newly formed mud banks. The sedimentation peak is gradually moving northwards. Mussels and sediment color are two useful biological indicators. Mussels in benthos exist in the same density as before in semiriverine sections; however, in lacustrine sections they are replaced by tubificids, up to 200 g sqm. Sediment color is brownish grey in upper parts, yellow in middle (lacustrine) and grey turning black near High Dam. (Danovich-Wisconsin)
W80-01786

OBSERVATIONS ON PHYTOPLANKTON AND PRIMARY PRODUCTIVITY IN VOLTA LAKE, GHANA,
Nigeria Univ., Nsukka.
S. Biswas.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1672-1676, 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Primary productivity, *Phytoplankton, *Population, *Chemical analysis, *Volta Lake, Ghana, Productivity, Ghana, Lakes, Plankton, Transparency, Temperature, Thermal stratification, Distribution, Methodology, Testing procedures, Analytical techniques, Evaluation, Water analysis, Africa.

In this 1970-71 study of phytoplankton primary productivity and population on Volta Lake, Ghana, phytoplankton varied with depth, making it impossible to obtain primary productivity data strictly according to homogeneous distribution rules; primary productivity therefore was calculated from chemical data alone. Both phytoplankton and oxygen were estimated from acidified samples treated with Winkler's reagents. The lake is not always fully homothermal and even when it is, vertical phytoplankton distribution is not necessarily homogeneous. Phytoplankton varies rapidly with oxygen. Secchi disk transparency decreases with phytoplankton increase. Progressive primary productivity decrease was observed from the lower to upper lake levels, relating phytoplankton population changes from a rising to declining phase in this lake. Using dark bottles for estimating oxygen, respiration loss is untenable due to phytoplankton decrease by death. Estimating primary productivity by direct free lake water methods is better than experimental methods due to restrictive bottle conditions. Integrated oxygen production in free lake water columns include respiration loss at non-photic depths; therefore, computed results are as good as net production. (Danovich-Wisconsin)
W80-01787

DIURNAL VERTICAL DISTRIBUTION OF ZOOPLANKTON DURING STRATIFICATION IN KAINJI LAKE, NIGERIA,
Kainji Lake Research Inst. New Bussa (Nigeria).
H. A. Adeniji.
In: Proceedings: Congress in Denmark 1977, part 3, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1677-1683, 9 Fig, 1 Tab, 9 Ref.

Descriptors: *Zooplankton, *Distribution, *Diel migration, *Distribution patterns, *Kainji, Lake Nigeria, Lakes, Thermocline, Hypolimnion, Epilimnion, Temperature, Ecological distribution, Rotifers, Copepods, Crustaceans, Phytoplankton, Light intensity, Light, Predation, Migration, Diurnal.

Many factors control diurnal vertical zooplankton migration in Kaniji Lake, Nigeria, including light intensity, water temperature, dissolved oxygen, food, reproduction responses, and predation avoidance. According to an April 1974 study, the lake's water column showed a thermocline between five and 10 m and a hypolimnion of 20-30 m. Oxygen content is 7.0 mg 21 near the surface but drops to 0.5mg 1 at 10 m; pH in epilimnion and thermocline layers is 7.0-7.4, but is in the acidic range, 6.6-6.8, in the hypolimnion. Zooplankton migrate to surface waters at dusk and then migrate downwards in the morning to 4 m depths. By noon they migrate to 8-10 m depths. Cladocera and Copepods are absent in the top 4 m at noon, avoiding solar brightness and high surface water temperatures. The thermocline, where zooplankton congregate at noon, has lower temperatures than surface waters; cooler temperatures are also associated with maximum reproductive potential. Rotifers are abundant in surface waters at noon when crustaceans are absent, indicating predation pressure response. Changes in light intensity are the major control in diurnal vertical migration. A diurnal vertical phytoplankton migration to surface waters at night also occurs. (Danovich-Wisconsin)
W80-01788

LARVAL SPOTTED SEATROUT (CYNOSCION NEBULOSUS) A BIOASSAY SUBJECT FOR THE MARINE SUBTROPICS,
National Marine Fisheries Service, Port Aransas, TX. Southwest Fisheries Center.
A. G. Johnson, T. D. Williams, J. F. Messinger, III, and C. R. Arnold.
Contributions in Marine Science, Vol 22, p 57-62, 1979. 2 Tab, 16 Ref.

Descriptors: *Toxicity, *Oil, *Trout, Bioassay, Larval growth stage, Growth stages, Water quality, Water chemistry, Mortality, Mode of action, Fish physiology, Length, Fish behavior, Fuels, Organic compounds, *Cynoscion, *Seatrout, *Crude oil, *Mutagens, *Teratogens.

Larval spotted sea trout were selected as the test subject because specimens can be produced under laboratory conditions throughout the year by adjusting the temperature and photoperiod. Tests were made to determine the sensitivity of spotted sea trout larvae to water samples from different environments and to Baton Rouge No. 2 fuel oil. Considerable variation in water quality was found within a small area with regard to larval mortality. Sublethal fuel oil concentrations (0.00-1.00 ppm) produced a general decrease in total body length and critical distance. An increase in unpigmented eyes occurred with an increase in fuel oil concentrations. (Deal-EIS)
W80-01840

HEAT RECIRCULATION INDUCED BY THERMAL DIFFUSERS,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-01879

THE EFFECT OF NICKEL ON THE GROWTH OF THE FRESHWATER DIATOM NAVICULA PELLICULOSA,
Notre Dame Univ., IN. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-01897

(GROWTH AND CHEMICAL COMPOSITION OF REED (PHRAGMITES AUSTRALLIS) AS RELATED TO WATER EUTROPHICATION), WACHSTUM UND CHEMISCHE ZUSAMMENSETZUG VON SCHILF (PHRAGMITES AUSTRALIS) IN ABHANGIGKEIT VON DER GEWASSEREULTROPHIERUNG.
Technische Univ., Berlin (Germany, F.R.). Inst. fuer Okologie.
F. Raghi-Atri, and R. Bornkamm.
Archiv fue Hydrobiologic, Vol 85, No 2, p 192-228, March, 1979. English summary and abstract. 5 Fig, 8 Tab, 89 Ref.

Descriptors: *Rooted aquatic plants, *Elements, *Eutrophication, *Effects, Plant morphology, Wetlands, Aquatic plants, Vegetation, Water quality, Nitrogen, Calcium, Potassium.

In order to evaluate the influence of water eutrophication on the development of the reed plant (Phragmites australis), at eight experimental plots within Berlin, the chemical composition of surface water, river-lake deposits and pore water have been investigated in relation to growth and chemical constituents of Phragmites. Regarding the performance of reed with increasing eutrophication the following reactions have been observed: (1) larger leaf area, (2) higher reduction of shoot number during the vegetation period, (3) increased contents of calcium and ash connected with decreased K:Ca ratio, (4) increased soluble N content in the whole plant, increased total N content in the stem. (Stihler-Mass)
W80-01913

ASPECTS OF THE ECOLOGY AND PHYSIOLOGY OF FRESHWATER MACROPHYTES: PHOSPHORUS CYCLING BY FRESHWATER MACROPHYTES: THE CASE OF SHAGAWA LAKE,
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 2H.
W80-01914

UPTAKE OF RADIONUCLIDES BY SOME AQUATIC MACROPHYTES OF ISMAILIA CANAL, EGYPT,

Atomic Energy Establishment, Cairo (Egypt). Radiation Protection Dept.
W. E. Y. Abdelmalik, R. M. K. El-Shinawy, M. M. Ishak, and K. A. Mahmoud.
Hydrobiologia, Vol 42, No 1, p 3-12, July 6, 1973. 5 Tab, 10 Ref.

Descriptors: *Radioisotopes, *Aquatic plants, *Bioindicators, Strontium radioisotopes, Phosphorus radioisotopes, Ismailia Canal, Egypt, Aquatic ecology.

Uptake of the radionuclides Co-60, Cs-134, Sr-89 and P-32, by different aquatic plants present in Ismailia Canal was found to increase at increasing initial concentrations of the radionuclides in the water. Maximum uptake was reached by most of the aquatic plants after different periods of contamination, ranging from 1 to 4 days. Certophyllum was found to be the most favorable biological indicator for strontium radioisotopes in concentrations ranging from 0.5 to 10 micron Ci/l and for contamination periods up to 16 days. Elodea was found to serve as a biological indicator for either strontium mor phosphorus radioisotopes for limited contamination periods of 2 to 16 days for Sr and to 2 days for P isotopes. Potamogeton was also found to serve as a biological indicator for limited contamination periods for strontium, phosphorus and cesium radioisotopes: 0 to 2 days for Sr, 2 to 16 days for P and 0 to 2 days for Cs isotopes. (Hinkel-Mass)
W80-01925

FIRE AND STREAM ECOLOGY IN SOME YELLOWSTONE LAKE TRIBUTARIES,
Humboldt State Univ., Arcata, CA.
D. P. Albin.
California Fish and Game, Vol 65, No 4, p 216-238, 1979. 7 Fig, 7 Tab, 21 Ref.

Descriptors: *Forest fires, *Forest management, *Streams, Watersheds management, National Parks, Streamflow, Stream erosion, Water temperature, Cutthroat trout, Fry, Runoff, Benthic fauna, Seasonal, Periphyton, Sediment transport, Yellowstone Lake, Yellowstone National Park.

This study attempted to clarify some effects of forest fires on streams in selected tributaries to Yellowstone Lake, Yellowstone National Park, in partial evaluation of the Park's natural burn fire management policy. In a stream in a watershed burned 45 and 36 years ago (Passage Creek) some changes were found, when compared to a similar stream in an unburned adjacent watershed (Chipmunk Creek). Summer stream temperatures averaged about 1.5C higher in Passage Creek. Streamflow showed a greater seasonal fluctuation and a higher water yield in Passage Creek. Water quality conditions in both streams were similar, but mineral export was greater in Passage Creek due to greater water yield. Aufwuchs accumulation on artificial substrates showed no significant difference between the two streams. Benthic sampling suggested a general increase in benthic macroinvertebrates in Passage Creek. The fry of Yellowstone cutthroat trout, Salmo clarki lewisi, appeared to emerge from the gravel earlier in Passage Creek than in Chipmunk Creek. Based on stream temperature differences, the difference in egg incubation time was calculated to be 4 days. Two other streams were studied during and immediately after a fire burned their watersheds. No harmful effects were found. Concentrations of calcium, magnesium, potassium, chloride, sulfate, phosphate, and total organic carbon were raised somewhat during a rainstorm, apparently as a result of ash leached into surface runoff. (Deal-EIS)
W80-01943

EFFECTS OF THE PIPELINE HAUL ROAD ON NEARBY PONDS AND LAKES ACROSS ALASKA'S NORTH SLOPE,
Alaska Univ., Fairbanks. Inst. of Marine Science.
V. Alexander, and M. C. Miller.
Report RLO-2229-T9-2, 1977. 104 p, 7 Fig, 17 Tab, 5 Ref, 2 Append. E(45-1)-2229.

Descriptors: *Roads, *Dusts, *Environmental effects, *Primary productivity, *Ponds, *Alaska, *Pipelines, Nutrients, Bioassay, Productivity, Granules, Highway effects, Roadbanks, Lakes, Oil industry, Leaching, Biomass, Oligotrophy.

In ponds within 0-5 m of haul roads servicing the Trans-Alaskan pipeline, significant annual productivity increases are observed due to settling road dust. During summer 1976, dustfall levels were monitored along coastal plain and foothills province transects. Road dust decreases from 1.5 to 12 g/sq m/d 10 m from road margins to 0.05 to 0.5 g/sq m/d at 300 m distance. Ponds created by road construction have the highest production rates (73.7 mg C/cu m/d) and algal biomasses (2.80 micro g chl/l). Leachates, from dust settled onto water surfaces, double algal biomass in nitrogen and phosphorus limited algal populations. These biomass increases are still within oligotrophic ranges. However, distances do not relate to any stimulation pattern. Closest pans received most dust material and have the highest biomass. Increasing road distance and decreasing total weight dust added to carboys does not result in stimulation depression. Finest dust fractions less than 1-2 micro m diameter may be responsible for biomass stimulation; these particles have the highest surface area per unit volume. Chemical and biological changes such as increasing alkalinity, nutrient concentrations, and water staining with brown dissolved humic materials, continue in newly formed ponds, especially in ones formed over terrestrial sedge communities. (Danovich-Wisconsin)
W80-01975

BLUE-GREEN ALGAL GROWTH AND SPORULATION IN RESPONSE TO SIMULATED SURFACE BLOOM CONDITIONS,
London Univ. (England). Dept. of Botany.
J. A. Rother, and P. Fay.
British Physiological Journal, Vol 14, No 1, p 59-68, 1979. 5 Tab, 29 Ref.

Descriptors: *Growth rates, *Cyanophyta, *Germination, *Plant physiology, Algae, Eutrophication, Reproduction, Aphanizomenon flos-aquae, Metabolism, Light, Light intensity, Environmental effects, Nitrates, Spores, Environmental effects, Physiological ecology, Plant growth, United Kingdom.

Sportulation in laboratory batch cultures does not appear until terminal growth stages, except one Aphanizomenon flos-aquae strain in HEPES-buffered media displayed akinetes when still actively growing. Growth and differetiation of unialgal isolates and natural Aphanizomenon flos-aquae populations from North Salop, England were investigated under laboratory conditions. Nutrients, buffer, light intensity environmental effects were examined. Di-peptide buffer N-glycyl-glycine at 0.5 g/l inhibits both heterocyst formation and sporulation whereas high nitrate concentrations (400 mg/l) reduces heterocyst frequency by only 50%. HEPES buffer has little effect on agal growth but stimulates akinete production and heterocyst frequency. Filtrates from sporulating and non-sporulating cultures do not stimulate sporulation. Algal cultures stop growing before terminal stages with low orthophosphate concentrations. At 10 mg/l orthophosphate inhibits sporulation, however, growth is not suppressed. Trace elements mixtures containing Mn, Zn, Co, Cu and Mo salts and chelated and unchelated iron do not induce sporulation rates greater than those in control cultures, although growth is reduced. Cultures in darkness or high light intensities, eight kix and above, do not grow or sporulate. Treatment with uv light does not encourage sporulation. With N-glycyl-glycine, A. flos-aquae cultures do not sporulate and heterocyst formation is suppressed, suggesting a relationship between heterocysts and akinetes. (Danovich-Wisconsin)
W80-01977

BROWSING AND GRAZING BY CLADOCERAN FILTER FEEDERS,
McGill Univ., Montreal (Quebec). Dept. of Biology.
P. A. Horton, M. Rowan, K. E. Webster, and R. H. Peters.
Canadian Journal of Zoology, Vol 57, No 1, p 206-212, 1979. 3 Fig, 2 Tab, 33 Ref.

Descriptors: *Animal behavior, *Daphnia, *Grazing, *Browse utilization, *Food habits, Zooplankton, Food abundance, Light, Light intensity, Productivity, Reproduction, Invertebrates, Biomass, Standing crops, Physiological aspects, Secondary productivity, Competition, Seston.

If planktonic food amounts are low, Daphnia magna and Daphnia pulex utilize sedimented material, giving these animals competitive advantage over other Cladocera such as Daphnia galeata and Ceriodaphnia quadrangula which feed solely on suspended food. This laboratory study relates suspended food concentration to feeding shifts from browsing to grazing by Daphnia pulex; three other cladocerans were examined to determine if feeding site choice is a relatively constant food level function among planktonic animals. D. pulex mainly forages in sediments when Scenedesmus food additions are less than 10,000 cells/ml. Even at low food levels, 20% to 40% of the animals swim into upper strata while others sink slowly to bottom again, indicating a preference for browsing rather than grazing. The shift is most pronounced in 10,000 to 100,000 cells/ml range; swimming animals numbers triple prefeeding density numbers. At higher food concentrations, swimming animal numbers decline. D. pulex is also very positively phototactic at high suspended food levels. Below 10,000 cells/ml, filtering rates are high but little food is collected. With increasing food, filtration rate is depressed but the ingestion rate remains constant. D. pulex does not sustain itself at 10,000 cells/ml; brood size falls to zero. At 25,000 cells/ml, brood sizes are close to maximum; when suspended food concentration falls below subsistence levels, D. pulex and D. magna cease to graze and instead browse. Neither D. galeata nor C. quadrangula show significant positional response to low food concentrations. (Danovich-Wisconsin)
W80-01978

AN INVESTIGATION OF DROUGHT AVOIDANCE IN INTERTIDAL FUCOID ALGAE,
Glasgow Univ. (Scotland). Dept. of Botany.
M. W. Schonbeck, and T. A. Norton.
Botanica Marina, Vol 22, No 3, p 133-144, 1979. 6 Fig, 6 Tab, 20 Ref.

Descriptors: *Kelps, *Intertidal areas, *Plant physiology, *Drought resistance, Drying, Droughts, Algae, Metabolism, Habitats, Adaptation, Drought tolerance, Plant growth, Growth rates, Environmental effects, Moisture stress, Physiological ecology, Water balance, Water storage, Great Cumbrae Island, Scotland.

A laboratory study of fucoid algae collected from Great Cumbrae Island shores, Scotland, demonstrates that drought avoidance is not the primary means by which Pelvetia and Fucus spiralis adapt to upshore habitats. Fucoid algae normally appear in well-defined zonal sequences with Pelvetia canaliculata highest on shore, followed by Fucus spiralis, then a mixed Ascophyllum nodosum and F. vesiculosis zone and finally lowshore species, F. serratus. Four means of drought avoidance are examined: physical evaporation barrier, hygroscopic substances, low surface to mass ratio, and specialized thallus shape and growth hatits. Epidermis of upshore fucoids offers only slight water loss resistance. F. spiralis and Pelvetia loose 79.5 micro g water/sq mm/h. At water potentials of -395 to -150 bars, F. spiralis retains significantly more water per 100 g Dw than either Pelvetia or F. serratus; while under drier conditions, the three species have similar hygroscopic capacities. Pelvetia consistently has highest dry matter content and percent of water bound. In small plants from F. serratus to Pelvetia, surface to mass ratio decreases, however, this reverses in adult plants. Similar surface to mass ratio Pelvetia segments dry faster than Fucus blades. Pronounced dessication rate differences between stipes and blades is evident in each species. Pelvetia exceeds F. spiralis considerably in weight and branch overlap degree. F. spiralis and Pelvetia can reach very low water potentials (96%) loss, yet when resubmerged and cultured, all plants survive. (Danovich-Wisconsin)
W80-01979

A PRELIMINARY STUDY OF ALGAL TURF COMMUNITIES OF A SHALLOW CORAL REEF LAGOON USING AN ARTIFICIAL SUBSTRATUM,

Sydney Univ. (Australia). Dept. of Botany.
M. A. Borowitzka, A. W. D. Larkum, and L. J. Borowitzka.

Aquatic Botany, Vol 5, No 4, p 365-381, 1978. 5 Fig, 4 Tab, 33 Ref.

Descriptors: *Biological communities, *Coral, *Reefs, *Artificial substrates, *Great Barrier Reef(Australia), *Marine algae, Algae, Australia, Metabolism, Biomass, Standing crops, Equipment, Laboratory equipment, Population, Distribution, Colonization, Succession, Grazing, Productivity, Speciation, Benthic fauna.

Rapid glass slide colonization rates by algae and almost immediate algal recovery after intensive grazing (except by coralline algae) in a 1972-1974 study at One Tree Island lagoon, Great Barrier Reef, Australia, show that turf algae are the most important primary producers in reef ecosystems. Bacteria and diatoms colonized slides within 24 h; after three months, slides were covered by filamentous and encrusting algae such as Sphacelaria tribuloides Meneghini, Herposiphonia tenella, Tenarea sp, and some invertebrates such as Spirorbis sp. Early colonizers include coralline and blue-green algal species. Grazing occurs sufficiently often so that few coralline crusts survive near glass slide centers. Eventually, thicker crustose corallines such as Porolithon onkodes, from less grazed slide edges begin to overgrow slides; this provides substratum for Laurencia and Lophosiphonia species which do not grow directly on slides. Observed edges effects in algal distribution are caused by water movement around and over substrate and differential grazing pressure near edges compared with flat central areas. Algal species numbers and abundance increase with time. Green algae such as Cladophoropsis, Chlorodesmis, and Cladophora, and small Laurencia plants, occur mainly inside micro-atolls or at four m depths. In reticulate reef enclosed parts green and brown algae are absent; however, coralline and blue-green algae grow abundantly. Coralline, blue-green, and red algae such as Ceramium are observed in slides near two large coral masses in open sandy areas. (Danovich-Wisconsin)
W80-01980

THE CULTURE COLLECTIONS OF ALGAE AT THE UNIVERSITY OF TEXAS AT AUSTIN,

Texas Univ. at Austin. Dept. of Botany.
R. C. Staar.

Journal of Phycology, Vol 14, supplement, p 47-100, December 1978. 243 Ref. NSF DES76-81979.

Descriptors: *Algae, *Texas, *Cultures, *Classification, *Research facilities, *Research equipment, Universities, University of Texas, Austin, Microbiology, Plant growth, Systematics, Laboratory tests.

This paper alphabetically lists algal cultures, maintenance media, and special growth media availale from the University of Texas and Austin. Culture orders are accepted by letter, purchase order or telephone from all interested individuals and organizations. Each culture is $4.00 postpaid for academic and nonprofit institutions; $10.00 per culture postpaid for commercial organizations. The Culture Collection of Algae was formerly located at Indiana University, Bloomington an moved to the University of Texas during 1976-1977. The National Science Foundation supports the collection as a national research resource. Information such as the strain isolator, idenity with strains in other collections, and use in publications is included. The algal collection includes Acetabularia Lamouroux, Peridinium Ehrenberg em. Stein, and Zygnema C. Agardh. Maintenance media ranges from Allen's medium, to ES enrichment for seawater, to YT20 medium. Special growth media ranges from Anacystis nidulans (Synechococcus leopoliensis) to Volvox. (Danovich-Wisconsin)
W80-01981

MODIFICATION OF PHOSPHORUS RETENTION MODELS FOR USE WITH LAKES WITH LOW AREAL WATER LOADING,

McGill Univ., Montreal (Quebec). Dept. of Biology.
M. L. Ostrofsky.

Journal of the Fisheries Research Board of Canada, Vol 35, No 12, p 1532-1536, December 1978. 4 Fig, 2 Tab, 12 Ref.

Descriptors: *Phosphorus, *Equations, *Lakes, *Retention, *Mathematical models, Model studies, Time, Mathematical studies, Nutrients, Water quality, Water properties, Waste assimilative capacity, Canada, Runoff, Streams, Correlation analysis, Graphical analysis, Mathematics, Rainfall.

Normal equations calculating phosphorus (P) retention do not hold for low areal water load lakes; therefore, this model study examines 53 lakes in the Canadian Shield area during 1975-1976 to find new relationships between P retention and areal water load (q-s). Lake P retention is usually determined from its q-s, calculated as average annual discharge (in cu m from excess precipitation), divided by lake surface area (sq m). Mathematical relationships between P retention and q-s are hyperbolic, and therefore, extremely sensitive to small q-s changes, particularly when q-s is low. Canadian Shield lakes experience low rainfall (25 cm/yr) and high evapotranspiration, insuring low q-s values. Surface areas range from 3.8 to 3375 ha, and q-s varies from 0.3 to 180 m/yr. Mean P concentration of winter and summer precipitation were 18.7 and 271.8 micro g/l, respectively, indicating a 0.4 kg P/ha/yr aeolian contribution. Stream export ranged 0.36 to 7.05 kg P/sq km/yr. In many cases, predicted and observed P concentrations did not agree. When relative error is graphed as a q-s function, large errors occur in q-s values less than 10 m/yr and predicted P concentration is always underestimated in this low q-s range. With the original data, new relationships between q-s and P retention were determined; several functions, including simple exponential, multiple polynomial, and logarithmic, fit and data well and an infinite number of plausible solutions give equally satisfactory results over observed data ranges. (Danovich-Wisconsin)
W80-01982

PHYSICAL AND CHEMICAL LIMNOLOGY OF LAKE RINIHUE (VALDIVIA, CHILE),

Universidad Austral de Chile, Valdivia. Inst. of Zoologio.
H. Campos, J. Arenas, W. Steffen, and G. Aguero.

Archiv fur Hydrobiologie, Vol 84, No 4, p 405-429, December 1978. 17 Fig, 4 Tab, 21 Ref.

Descriptors: *Chile, *Lakes, *Chemical properties, *Physical properties, *Seasonal, *Lake Rinihue(Chile), Physiocochemical properties, Limnology, Stratification, Fjords, Color, Transparency, Temperature, Dissolved oxygen, Nitrates, Silica, Rainfall, Light.

This May 1975-1976 study of water property changes and trophical situations in Lake Rinihue, a warm, monomictic, oligotrophic lake, near Valdivia, Chile, shows marked seasonal changes from winter to spring. Variations are influenced by local climatic components such as wind speed and direction, rainfall, air temperature, and cloudiness. High winter winds produce strong waves, water overturn, and higher precipitations. Spring winds influence the warming periods, prevent thermal stratification by upper strata mixing, and maintain low spring thermal stability. Summer winds modify epillimnion thickness and temperatures 15 m down may reach 13 C. Maximum and minimum rainfall determine high and low effluent flow; the drainage area is 53.1 times larger than the lake area. Two seasonal vertical water temperature cycles were observed: a winter circulation warming up period begins in October and highly stable vertical columns produce summer stagnation in February. Chemical concentrations vary greatly winter to spring. During winter circulation periods, concentrations of conductivity, bicarbonate alkalinity, hardness, anions and cations, silica and oxygen are low. Only sulfate and nitrate show higher winter concentrations than in spring. Silica ranges 0.8 to 3.0 mg 1 in winter and increases notably to 8-12 mg 1 in spring and summer. Nitrate, fluctuating 5.75 micro g/1, is the only solute displaying marked seasonal stratification. In spring and summer, concentrations decrease in the surface, while they increased in deep layers. These two concentrations become one during winter circulation. (Danovich-Wisconsin)
W80-01983

PRIMARY PRODUCTIVITY OF A HYPERSALINE ANTARCTIC LAKE,

Victoria Ministry of Conservation, Melbourne (Australia).
P. J. Campbell.

Australia Journal of Marine and Freshwater Research, Vol 29, No 6, p 717-724, December 1978 2 Fig, 2 Tab, 18 Ref.

Descriptors: *Primary productivity, *Saline lakes, *Algae, *Antarctic, Lakes, Speciation, Biomass, Productivity, Light, Temperature, Saline water, Salt to tolerance, Plankton, Phytoplankton, Cold regions, Polar regions, Environmental effects, Physiological ecology.

Deep Lake, Antarctica, has very low productivity, 3.3 g C sq m h, compared with 9.8 mg C sq m h for Watts Lake, another Antarctic lake, making Deep Lake one of the least productive lakes recorded. Due to high salinity (270 g 1), Deep Lake remains ice-free throughout the year despite low ambient temperatures ranging from +10 to -16 C. Biota in the 0.58 sq km lake consists of two unidentified unicellular green algae species and several species of bacteria; however, invertebrates and herbivorous organisms are absent. Water samples and temperature measurements were taken January 1975 to January 1976, near the lake center where depths are 33.5 m. Twelve in-situ experiments were performed in Deep Lake. Significant primary production was recorded only once; a sample collected near the bottom after sediments were disturbed gave a value of 0.18 mg C cu m h. With all other experiments, the level of production was below the detection limit (0.15 mg C cu m h). A 3.3 g C sq m upper phytoplankton production limit in Deep Lake was calculated assuming a production zone from 0-15 m fo six months at a 0.1 mg C cu m h rate and 12 h day length. Speices diversity, population, and productivity are limited by nutrient deficiency, hypersalinity, low temperature, and annual light level extremes. (Danovich-Wisconsin)
W80-01984

ZOOPLANKTON DISTRIBUTION IN RELATION TO THE HYDROLOGY OF THE DERWENT RIVER ESTUARY,

Tasmania Univ., Hobart (Australia). Dept. of Zoology.
N. Taw, and D. A. Ritz.

Australian Journal of Marine and Freshwater Research, Vol 29, No 6, p 763-775, December 1978. 5 Fig, 14 Ref.

Descriptors: *Estuaries, *Zooplankton, *Ecological distribution, *Copepods, Tasmania, Australia, Plankton, Distribution, Bioindicators, Estuarine environment, Rivers, Aquatic animals, Salinity, Saline water-freshwater interfaces, Tides, Tidal waters, Tidal streams, Tidal effects, Habitats.

A 1973-1974 study of the Derwent River in southeast Tasmania, Australia showed correlation between hydrologically established zones and zooplankton distribution. The most significant river region both hydrologically and in zooplankton distribution terms is the tidal zone. Both major estuarine species and marine species are found in this zone. Two cruises, one in October 1973 and the other in April 1974, were selected to cover high and low freshwater flow periods at the lower 50 km of the Derwent River. Four estuarine zones are classified according to hydrological characters and bottom deposits: marine, tidal, gradient, and freshwater. Gladioferens pectinatus is the most abundant estuarine species ranging up to 5,000 adults cu m and distributed throughout most of the river. Sulcanus conflictus is abundant in the tidal and gradient zones ranging in number up to 800 copepodites cu m. This species is limited to salinities of 4-23%. Cyclopoid Mesocyclops leuckarti and ca-

lanoid Boeckella triarticulata are confined to freshwater. In the marine zone, two calanoid copepod species, Paracalanus parvus and Acartia tranteri dominate zooplankton populations. During October the number of adults increases downstream and reaches maximum in marine areas. Copepodites prefer the tidal region. In April, adults dominate the population in all areas. Both adults and copepodites concentrate in marine areas. Apart from major flood periods, only minor zonation shifts occur in the Derwent estuarine system. (Danovich-Wisconsin)
W80-01985

DENITRIFICATION IN NATURAL WATERS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
P. L. Brezonik.
Progress in Water Technology, Vol 8, No 4-5, p 373-392, 1977. 1 Fig, 2 Tab, 111 Ref.

Descriptors: *Denitrification, *Biochemistry, *Sediments, *Natural streams, *Nitrate, *Reviews, Nitrogen, Nitrogen cycle, Anaerobic conditions, Aquatic productivity, Nitrogen gases, Ammonia, Eutrophication, Microbiology, Sediment-water interfaces, Oceans, Lakes, Lake Mendota(WI).

A general review of denitrification shows it is an important sink for nitrogen in the biosphere but that quantification of its role in specific water bodies is elusive. Rates of denitrification in anoxic systems are probably limited more by availability of oxidizable substrates than by any other environmental factor. Information is needed not only on nitrogen sources but also on dissipative reactions or nitrogen sinks. The role of oxygen in denitrification is controversial, however, denitrification is presemed to require anoxic conditions. Denitrification ceases upon exposure of microorganisms to oxygen only after a period of adjustment. Given an anoxic environment and the presence of nitrate, the primary factor affecting the denitrification rate is the concentration of biodegradable organic matter. Since the product of denitrification is a gas, N2, precise determinations of denitrification rates are difficult. Denitrification rates vary in sediments 5-60 mgn/ sq m - hr in cores from English rivers and is 8.3 g N/ sq m - yr in a Danish lake. New techniques are still being sought for measurements of lake denitrification. The current techniques strongly depend on accuracy of the nitrogen budget and the groundwater contribution of nitrates. Although in-situ determinations of oceanic denitrification rates are difficult, values range from 1 x 10 to the 13th power g/yr to 2.3 x 10 to the 14th power g/yr nitrogen loss via denitrification in eastern tropical north Pacific. Denitrification rates are important in determining oceanic global nitrogen balances, nitrogen budgets for fresh water bodies, and nitrate fertilizer losses to the soil. (Danovich-Wisconsin)
W80-01989

BIOLOGICAL AVAILABILITY OF LOW VERSUS HIGH MOLECULAR WEIGHT REACTIVE PHOSPHORUS,
North Carolina Univ., Morehead City. Inst. of Marine Sciences.
H. W. Paerl, and M. T. Downes.
Journal of the Fisheries Research Board of Canada, Vol 35, No 12, p 1639-1643, December 1978. 2 Fig, 3 Tab, 13 Ref.

Descriptors: *Growth rates, *Chorella, *Phosphorus, *Bioassay, *Cycling nutrients, Phosphorus compounds, Algae, Phosphates, Orthophosphate, New Zealand, Lakes, Nutrients, Nutrient removal, Nutrient requirements, Turnovers, Time, Kinetics.

Chlorella preferentially utilize free orthophosphate (PO4) over reactive high molecular weight phosphorus (RHMWP) in two New Zealand Lakes, but given enough time in PO4 absence, RHMWP is utilized as well. This summer study compares short-term PO4 turnover between lakes showing high and low proportions of reactive phosphorus (P) present as PO4. Long-term biological availability of both RHMWP and PO4 is also tested by P-starved Chlorella culture inoculations. In Lake Tutaeinanga, New Zealand, 0.5 mg/cu m is PO4 out of 41 mg/cu m total reactive P; in Lake Okaro 44 mg/cu m is PO4 out of 50 mg/cu m total reactive P. No detectable PO4 turnover is found in Okaro, whereas Tutaeinanga shows a 3.7 h turnover time. In addition to PO4 pool size, turnover rates depend on temperature, light, and microbial biomass. Biomass is 1150 mg C/cu m for Okaro and 1075 mg C/cu m for Titaeinanga. In July, reactive P pool analysis following Sephadex fractionation reveals 80% of reactive P in Okaro is free PO4, while in Tutaeinange 20% of reactive P is free PO4. Bioassay parameters indicate that PO4 has more immediate Chlorella growth stimulatory effect than equivalent RHMWP amounts. In short-term incubations, although RHMWP is less available, this faction eventually is utilized to the same extent as PO4. This explains why turnover times in Tutaeinanga are several hours instead of a few minutes. (Danovich-Wisconsin)
W80-01990

MULTIPLE INTERACTION OF FACTORS IN THE DISTRIBUTION OF SOME HAWAIIAN GELIDIALES (RHODOPHYTA),
Hawaii Univ., Honolulu. Dept. of Botany.
B. Santelices.
Pacific Science, Vol 32, No 2, p 119-147, 1978. 26 Fig, 2 Tab, 61 Ref.

Descriptors: *Rhodophyta, *Hawaii, *Distribution, *Reefs, *Plant physiology, Algae, Biomass, Light intensity, Water circulation, Growth rates, Nutrients, Productivity, Limiting factors, Distribution patterns, Resistance, Intertidal area, Movement, Water temperature, Salinity, Ecological distribution.

Field and experimental work July 1973 to July 1974 indicate that specific differences in tolerance ranges and optima levels of light intensity, water movement, and their combined effects most probably cause observed gelidiales distribution off the island of Oahu, Hawaii. Temperature and salinity produce significant effects only at experimental values exceeding filed observed values. Pterocladia caerulescens is restricted to nearshore reef edges, P. capillacea occurs in seaward reef margins, and Gelidiella acerosa extends across flat areas overlapping the two other species. Average reef biomass is 1.75 gDwt/sq m for P. caerulescens, 1.47 g Dwt/sq m for G. Acerosa, and 0.71 gDwt/sq m for P. capillacea. Pterocladia thallus size and horizontal distribution and all three species' biomass have seasonal cycles with maxima in December and minima in May. The three species have low light saturation values and their thalli appear pale or bleached when exposed to full sunlight. Full sunlight is tolerated by G. acerosa and P. caerulescens, but is detrimental to P. capillacea. Highest water movement values are optimal for P. capillacea, but limiting for P. caerulescens and G. acerosa. Experimental results show close relationships between water movement, diffusion and algal growth. High water movement, high water renewal rate, or nutrient addition allows all three species, within their individual limits, to utilize more efficiently higher light and temperature levels, as shown by absence of bleaching and faster growth. (Danovich-Wisconsin)
W80-01991

MATHEMATICAL MODELLING OF EUTROPHIED COASTAL AREAS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
K. I. Dahl-Madsen.
Progress in Water Technology, Vol 10, No 5-6, p 217-235 1978. 15 Fig, 27 Ref.

Descriptors: *Mathematical models, *Eutrophication, *Coasts, *Equations, Waste water, Denmark, Hydrodynamics, Statistics, Cytological studies, Water quality, dispersion, Nutrient transport, Zooplankton, Phytoplankton, Detritus, Nitrogen, Cycling nutrients, primary production, Sediments, Macrophytes, Phosphorus.

Since some Danish regulations allow waste water discharges into shallow coastal areas, mathematical models of the combined hydraulic and biological/chemical processes in the discharge area have been developed. Variables used in the model equations are significant in describing the eutrophic water system. However, the biological and chemical variables must not be over-emphasized; the physical transport processes must also be included. Most models focus on phytoplankton growth including intracellular nutrients and emphasize obtaining a firm hydraulic basis. A description of chlorophyss-a as a state variable and an abundance of fish in the area should be included. In shallow nearshore marine areas, macrophyutes may contribute considerably to total primary production and should also be incorporated into the model. Nutrient exchange rates between water and sediment are important. The combined transport dispersion and reaction model was favorably tested and used in calculating the consequences of waste water plans. Models for the years 1970-1977 were compared for 15 marine coastal water system. Two guidelines were suggested for further work; keep models general and communicate output to decision makers. (Danovich-Wisconsin)
W80-01993

WATER CONDITIONS IN THE STOCKHOLM ARCHIPELAGO AFTER THE INTRODUCTION OF BIOLOGICAL AND CHEMICAL PURIFICATION OF WASTE WATER,
Stockholm Water and Sewerage Works (Sweden).
M. Cronholm, and K. Abennerstedt.
Progress in Water Technology, Vol 10, No 5-6, p 273-295 1978. 17 Fig, 15 Ref.

Descriptors: *Stockholm, Sweden, *Waste water treatment, *Water pollution control, *Pollution abatement, *Sewage disposal, Oxygen, Islands, Ammonia, Water pollution, Lake Malaren, Sweden, Nitrogen, Phosphorus, Anaerobic conditions, dentrification, Sediments, Nutrient removal.

Since biological and chemical purification of all waste water released into Stockholm's inner archipelago began in 1970, formation of hydrogen sulfide in deep waters, biochemical oxygen consumption, and phosphorus pollution all decreased from 980 tons to 98 tons by 1976. The Stockholm archipelago, a group of 24,000 islands, has long been used as the Stockholm waste water recipient. Water quality has been monitored since the late 19th century, noting an oxygen deficiency, hydrogen sulfide in inner areas, and surface algal turbidity. The six waste water treatment plants presently serve 860,000 people and some of the waste water is mixed with deep archipelago water before it is discharged. After purification began many poitive effects were seen: In 1974-1976 very little phosphorus was retained in the sediments, however, there was much nitrogen loss, primarily due to deitrification. While the total nitrogen-total phosphorus waste water load ratio was 30:1 the recipient surface water ration was 15:1. The chlorphyll content was lower in 1974-1976 than in 1970-1972 and a corresponding increase of 0.5-1m was shown in transparency measurements. The biochemical waste water oxygen consumptions increased from 1000 tons/yr in the early 20th century to 10,000 1900-1950. A considerable decrease between 1969-1972 occurred as a result of the purification. (Danovich-Wisconsin)
W80-01994

THE SIGNIFICANCE OF PLANT NUTRIENT YIELDS IN RUNOFF FROM A MIXED LAND USE WATERSHED,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
T. J. Grizzard, C. W. Randall, R. C. Hoehn, and K. G. Saunders.
Progress in Water Technology, Vol 10, No 5-6, p 577-596, 1978. 5 Fig, 6 Tab, 12 Ref.

Descriptors: *Land use, *Storm water, *Runoff, *Nutrient loading, *Occoquan Reservoir, *Water pollution sources, Watershed, Nutrients, Rural areas, Equations, Storm runoff, Urban runoff, Virginia, Washington(DC), Potomac River, Water pollution control, Mathematical models, Nitrogen, Phosphorus.

Runoff accounts for the greatest nitrogen and phosphorus loadings to Occoquan Reservoir, located in Virginia at the mouth of a major tributary

to the Potomac estuary. Point sources alone produced 14.8% of total reservoir nitrogen and 11.7% of total reservoir phosphorus during periods of low runoff indicating the continuing importance of point source pollution. The Occoquan Reservoir, used as a water supply for 600,000 people and draining a 148,000 ha watershed, experienced cultural eutrophication in the 1960's displaying fish kills, nuisance algal blooms, and hypolimnetic deoxygenation. The reservoir serves two subbasins: one urban and one rural. During fiscal year 1975-1976, flow-weighted composit samples were obtained from seven automatic pumping sampler stations. Automated analysis systems determined levels of nitrogen and phosphorus and a summary of these nutrient loadings were obtaned from log-linear regression analyses of the data. The rate of nutrient production on an individual-event basis was a function of land use with urban lands generating significantly more nitrogen and phosphorus per ha than rural lands. The urban lands produced 2.3% more nitrogen and 2.0% more phosphorus annually on a unit area basis than rural lands. On an absolute basis these ratios were 1.3 and 1.1 respectively. U.S. attention has mainly focused on point source discharges of industrial and domestic wastewaters and the availability of federal pollution abatement funds has been depleted. However, recent studies indicate non-point pollution sources may be highly significant in determining receiving water quality. (Danovich-Wisconsin)
W80-01995

THE DISTRIBUTION, ABUNDANCE, COMMUNITY STRUCTURE, AND PRIMARY PRODUCTIVITY OF MACROORGANISMS FROM TWO CENTRAL CALIFORNIA ROCKY INTERTIDAL HABITATS,
California State Univ., Fullerton. Dept. of Biological Science.
R. R. Seapy, and M. M. Littler.
Pacific Science, Vol 32, No 3, p 293-314, 1978. 9 Fig, 5 Tab, 19 Ref.

Descriptors: *Intertidal areas, *Habitats, *Rocks, *Biological communities, *Primary productivity, California, Benthos, Tidal effects, Tides, Speciation, Distribution, Standing crops, Distribution patterns, Waves(water), Cyanophyta, Mussels, Invertebrates, Sessile algae, Coasts, Systematics.

Standing stocks of algae, community structure, and primary productivity of a wave-washed, steeply sloping sea stack was contrasted with nearby sheltered, gently sloping boulder beach at Cayucos Point, central California, from 1973 to 1976, quantitatively documenting marked biological differences between these two prominent rocky intertidal habitats. The boulder beach is protected by a large rock promontory, while the sea stack is inundated by large breakers during high tides. Mahor site differences are vabe shearing forces and habitat structure. Macroinvertebrates such as mussels, barnacles, and limpets dominate upper and middle intertidal zones with high shearing forces. Sea stack animal dominance lowers overall community productivity, 116.5 mg C/sq m/h, and results in marked animal/plant break between upper and lower shore areas. Crevices, angled substrates, and rivulets at boulder beach result in less pronounced vertical zonation patterns and macrophyte predominance; community productivity is 169.7 mg C/sq m/h. Blue-green algae and Endocladia muricata are the most abundant macrophytes at both sites. Sessile macrionvertebrates such as Mytilus californianus, Chthamalus fissus, and Balanus glandula dominate the sea stack. Sesslie Anthopleura elegantissima, C. fissus, and c. dalli, and mobile macroinvertebrate, Tegula funebralis, are the most numerous species at boulder beach. Greater taxa numbers and higher species richness values occur at boulder beach; however, evenness index and Shannon's index indicate higher diversity on the sea stack. (Danovich-Wisconsin)
W80-01996

THE THEORY OF CONTROL OF MICROBIAL GROWTH KINETICS BY LIMITING NUTRIENT CONCENTRATIONS,
Alaska Univ., Fairbanks. Inst. of Marine Sience.
D. K. Button.
Deep-Sea Research, Vol 25, No 12, p 1163-1177, 1978. 5 Fig, 1 Tab, 49 Ref.

Descriptors: *Theoretical analysis, *Nutrients, *Growth rate, *Aquatic microorganisms, *Kinetics, Model studies, Algae, Bacteria, Sea water, Limiting nutrients, Nutrient transport, Nutrient flax, Phosphates, Carbon, Glucose, Equations, Marine microorganisms, Cycling nutrients.

Formulations of growth kinetic expressions relating nutrient concentration to nutrient transport and to nutrient limited growth rate are derived in an attempt to develop a theoretical foundation for marine microorganisms-nutrients relationships. Examples show that nutrient transport restricts maximal growth rate only in certain instances. It is demonstrated that normal vairations in cell yield from substrate consumed at various growth rates can affect growth kinetic curves, an effect unrelated to saturation phenomena. Nutrient uptake and growth rate are plotted against nutrient concentration for a number of siturations, and kinetic constants for these curves are discussed. Thresholds, Michael's constants and affinities are examined; the latter, more closely defined here than in previous studies, is suggested as one of the more useful constants for describing kinetics of aquatic microbial processes. Also considered are the limiting nutrient concept, the cell quota concept, transient state versus steady state conditions, and population measurements. Understanding of growth kinetics in the marine environment is currently limited by insufficient knowledge of active transport mechanisms and inability to discriminate among small concentrations of biochemicals. (Luedtke -Wisconsin)
W80-01998

5D. Waste Treatment Processes

STATISTICAL ANALYSIS OF STREAM EVENTS AS APPLIED TO CONTROLLED RELEASE OF LAGOON EFFLUENTS,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
V. L. Zitta, and B. A. Mowry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116288, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Report, October 1979. 50 p, 20 Fig, 1 Tab, 8 Ref. OWRT A-126-MISS (1), 14-34-0001-9026.

Descriptors: *Waste water disposal, *Water pollution control, *Controlled release, Streamflow, Hydrographs, Statistics, Waste water, Discharge, Lagoons, Effluents.

High construction and operating costs of alternative waste treatment processes dictate the retention of lagoons as a waste management alternative for small towns with less than 2 mgd flow and for towns located on 'water quality limited' stream segments. Retention of lagoons is possible provided secondary treatment standards and stream quality criteria are met. The first criteria is met by lagoon design and the second can be met by discharge of the effluent during stream events. An event is defined as a maximum on the hydrograph irrespective of magnitude or time of occurrence. This research is an attempt to establish the methodology applicable to the hydrologic design of waste discharge into natural streams with characteristic rise and fall of a stochastic nature. The lognormal distribution function was deemed adequate by the Kolmogorov-Smirnov test to describe the histograms of maximum annual spans between stream events. Based on the span between events, the time of storage during low flow periods can be specified with a given cumulative probability or return period. Based on this return period the size of a storage system can be determined for given volumetric inflow rates.
W80-01605

INDUSTRIAL WASTEWATER TREATMENT FOR INDUSTRIAL PARKS IN TAIWAN,
Taiwan Industrial Development Bureau, Taipei.
S. Chen, C. P. Chen, and T. Y. Lee.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited b E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc. in USA). p 71-76, 1978. 1 Tab.

Descriptors: *Waste water treatment, *Industrial parks, *Taiwan(China), Water quality, Water quantity, Treatment facilities, Operation and maintenance, Planning, Design, Standards, Waste discharge, Fee rating.

Past experiences indicate that the quantity and quality of wastewater actually treated differ greatly from those assumed in the design of industrial wastewater treatment plants. These call for a high flexibility of the treatment system and the staged construction of the plant based on indexes obtained from pilot plant studies. In the Republic of China, the training of operators is being speeded up to ensure proper operation and maintenance of the plant. Various studies seeking a practical and rational fee-rating system are also being undertaken. (Bell-Graf--Cornell)
W80-01614

REVIEW OF SELECTED INDUSTRIAL WASTE TREATMENT PLANTS IN SINGAPORE,
L. Menon.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, V.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 261-277, 1978. 3 Fig, 4 Tab.

Descriptors: *Industrial wastes, *Treatment facilities, *Waste treatment, *Standards, *Watercources, *Singapore(Malaya), Sludge, Effluents, Seweres, Textiles, Chicken processing, Dyeing, Bleaching, Governments.

To illustrate the expertise available and experience gained in this region, the paper reviews three selected industrial waste treatment plants in Singapore. Industrial waste problems, methods of treatment, operational experiences and final effluent of the selected textile, chicken and food processing plants to meet Singapore Government legislated sewer and watercourse standards and tariff schemes are examined. Important points in the investigation, design and operation of industrial waste treatment plants are summarized. The essential first step is that the factory should be encouraged to practice good housekeeping, water-saving and process control to minimize the cost of treatment of the wastes. (Bell-Graf--Cornell)
W80-01635

PROTEIN PRODUCTION FROM CELLULOSE WASTES,
Queensland Univ., Brisbane (Australia). Central Animal Breeding House.
D. P. Henry, and P. F. Greenfield.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 279-286, 1978. 2 Fig, 4 Tab, 9 Ref.

Descriptors: *Waste water treatment, *Protein production, *Cellulose, *Wastes, Streams, Feed lots, Digestion, Volatile fatty acids, Anaerobic fermentation, Yeast growth, Nutritive value, Economic potential.

A description is given of a process which treats cellulose-rich waste streams such as those from intensive animal feedlots by converting the waste materials to volatile fatty acids under anaerobic conditions and then producing yeast aerobically using the fatty acids as principal substrates. The process has potential in treating concentrated wastes and in converting other cellulosic materials such as grasses to protein. (Bell-Graf--Cornell)

W80-01636

ENERGY AND USEFUL BY-PRODUCT RECOVERY FROM ANIMAL WASTES,
Food and Agriculture Organization of the United Nations, Malaya (Singapore).
E. P. Taiganides.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B. N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 315-323, 1978. 4 Fig, 4 Tab, 8 Ref.

Descriptors: *Energy, *Byproducts, *Recovery, *Animal wastes(Wildlife), *Technology, *Costs, Fertilizers, Anaerobic digestion, Gases, Plant nutrients, Pryolysis, Bihugas plants.

Animal wastes are 'resources out of place.' They contain sufficient quantities of nitrogen, phosphorus, potassium and micronutrients which serve as well-balanced fertilizers for plant growth and also as soil conditioners. Plant nutrients are in readily available forms and may be recovered in soil-plant systems within 3 years. Animal wastes may be converted to feed components through concentration by dehydration, by fermentation as silage, and/or by fungi/yeast, and by concentration into cellular bacterial or algal protein. Animal wastes contain energy which may be recovered as gas energy by anaerobic digestion or as solid/liquid energy by pyrolysis. Their energy content can also be reclaimed when using manures as animal and/or plant feed. This paper delineates the levels of technologies and costs for the utilization of animal wastes as plant nutrients and for energy recovery. (Bell-Graf--Cornell)
W80-01639

WASTE TREATMENT AND METHANE PRODUCTION BY A PLASTIC-MEDIA ANAEROBIC FILTER,
Technische Hochschule, Darmstadt (Germany, F.R.). Inst. for Wasserversorgung, Abwasserbeseitigung und Raumplanung.
K. Suwarnarat, and W. Weyrauch.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 325-336, 1978. 5 Fig, 3 Tab, 9 Ref.

Descriptors: *Waste treatment, *Methane, *Anaerobic filter, *Evaluation, Biochemical oxygen demand, Experiments, Influent, Loadings, Synthetic waste preparation, Plastic contact media.

The performance of anaerobic filter using plastic contact media was evaluated using synthetic media with biochemical oxygen demand of 3,000 mg/l. The process could remove 49 to 86% of the influent BOD at loadings of 5.7 and 10 kg of BOD/cu m-d respectively. In terms of the reactor volume requirements, the anaerobic process has a higher efficiency. (Bell-Graf--Cornell)
W80-01640

BIODEGRADATION OF PALM OIL SLUDGE AND ITS WASTE RECOVERY AS AN ENERGY SOURCE FOR ANIMALS AND SOIL AMENDMENT,
Universiti Sains Malaysia, Penang. Pusat Pengajian Sains Kajihayat.
P. M. Sivalingam.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 337-349, 1978. 6 Fig, 6 Tab, 11 Ref.

Descriptors: *Biodegradation, *Energy, *Sludge, *Palm oil, *Waste recovery, Animals, Soil amendment, Canal system, Industries, Malaysia, Treatment effects, Fermentation, Fish feed, Feasibility, Experiments, Biochenmical oxygen demand.

Extensive investigations on the efficiency of the currently practiced biodegradational canal system method of treating palm oil mill sludge have indicated that this mode of waste treatment is quite effective in lowering the BOD load. As such, an alternative means of palm oil sludge treatment is discussed. The utilization of plam oil sludge as a soil amendment and fish feed has also been investigated. Further, the feasibility of culturing a strain of Chlorella sp. isolated from the irrigational biodegradational canal system in fermented palm oil sludge supernatant and original sludge as an energy source for both human and fish consumption is also discussed. Experimental results indicate that the currently practiced irigational biodegradational canal system of treating palm oil sludge is practically inefficient, at least at the Batu Kawan Palm Oil Estate in Malaysia, and as such the polluting effect can be eliminated by the alternative fermentation processes suggested by Webb et al. (1975). With proper amendments, the sludge solids can be utilized as organic soil amendments and also as feed to carps. (Bell-Graf--Cornell)
W80-01641

MARICULTURE--BIOLOGICAL TREATMENT INDUSTRY,
McGill Univ., Montreal, (Quebec). Dept. of Chemical Engineering.
B. Volesky, and P. Tsantrizos.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 351-363, 1978. 4 Fig, 2 Tab, 20 Ref.

Descriptors: *Waste water treatment, *Biological treatment, *Algae, *Economic feasibility, *Mariculture, Industries, Nutrient removal, Biochemical oxygen demand, Tertiary treatment, Experiments, Animal feed, Ecosystems, Purification, Ponds, Influent, Costs, Sewage, Effluents.

Gradual growth of industry in developing countries leads to the discharge of increasing quantities of polluted or partially polluted waters. In favorable climates, the organic and inorganic content of wastewaters can be converted in marine-aquaculture systems into a needed commodity such as fish, lobster and oyster crops. A seaweed system alone is capable of nitrogen removal in an area of 60 acres with annual production of 16,300 tons net weight of seaweeds. The mariculture system can utilize local manpower and skills and simultaneously reduce the waste BOD loadings and achieve nutrient removals, enabling the exceedence of requirements for tertiary treatment contamination levels. Experimental investigations are discussed which have been carried out in several centers around the world on algal and mariculture systems. Animal feed materials recovered from algal operations and products of the controlled ecological systems are considered. Feasibility and econoomics of the controlled aqueous ecosystem for purification of wastewaters are briefly analyzed. (Bell-Graf--Cornell)
W80-01642

ANAEROBIC DIGESTION--OPTIMIZATION OF ENERGY SOURCE FROM WASTES,
McGill Univ., Montreal (Quebec). Dept. of Chemical Engineering.
B. Volesky.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA) p 365-372, 1978. 3 Fig, 1 Ref.

Descriptors: *Anaerobic digestion, *Waste water treatment, *Waste water disposal, *Energy source, *Developing countries, Biological treatment, Wastes, Biochemistry, Microbiology, Kinetics, Digesters, Methane yields, Technology, Optimization, Costs.

Anaerobic digestion, a traditional biological process for waste disposal, is receiving new and intense attention due to its relative simplicity and a potential to produce combustible gases. The attractiveness of anaerbic digestion for treatment of high-strength wastes in developing countries is associated with its flexible scale and low demands for more sophisticated technology. The system can be used locally as an alternative source of fuel energy for cooking, heating and driving engines. The successful use of anaerobic digestion technology for purification of household and farming wastes as well as high strength wastes originating from industrial operations is the key to efficient fuel gas mixture production which would help to alleviate the energy crisis. Description of the process is presented with evaluation of efficiences and operating parameters. Biochemistry, microbiology and kinetics of this complex microbial process are mentioned, leading to better understanding of its function which should result in the design of new types of reactors, enabling optimization of some key operating parameters. Further trends and areas are identified where development is required by interdisciplinary professions. (Bell-Graf--Cornell)
W80-01643

TECHNOLOGY TRANSFER FROM DEVELOPED TO DEVELOPING COUNTRIES IN THE AREA OF COMMUNITY WASTEWATER MANAGEMENT,
ADI Ltd., Fredericton, (New Brunswick).
T. Viraraghavan, and V. Raman.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B. N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 375-379, 1978. 2 Ref.

Descriptors: *Municipal water, *Waste water treatment, *Technology, *Developing countries, Waste water(Pollution), Management, Developed countries.

The transfer of technology from developing countries should not conflict with locally appropriate technology. The areas in which technology would be desirable and realistic are discussed. An international research center in environmental engineering for developing countries which would act as a focal point in technology transfer is proposed for an orderly and effective transfer of technology. (Bell-Graf--Cornell)
W80-01644

SEWAGE TREATMENT WORKS FOR SMALL COMMUNITIES--A NEED FOR CAREFUL DESIGN AND OPERATION,
National Inst. for Water Research, Pretoria (South Africa).
R. J. L. C. Drews, and J. H. Denysschen.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N. C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 381-397, 1978. 7 Fig, 1 Tab, 9 Ref.

Descriptors: *Sewage treatment, *Treatment facilities, *Design, *Operation and maintenance, Improvement, Stabilization, Ponds, Biological treatment, Purification plants, Biological filter plants, Activated sludge plants, South Africa.

An account is given of design faults, operational shortcoming and malfunctioning of units of small sewage works and the measure suggested for the improvement of plant performance. The observations made in practice pertain mainly to facultative (stabilization) pond systems, conventional biological filter plants and to extended aeration type activated sludge plants; they are meant to stimulate critical regular inspection of purification plants, which should lead to prompt application of practical corrective measures. Emphasis is placed on the need for properly trained, interested and motivated operators even for the smallest treatment works. (Bell-Graf--Cornell)
W80-01645

CASE STUDY OF EXISTING WASTEWATER FACILITIES OF SURAT--AN INDIAN TOWN,
S. V. Regional Coll. of Engineering and Technology, Surat (India). Dept. of Civil Engineering.
G. Ramprasad.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA) p 407-413, 1978. 4 Fig, 3 Tab.

Descriptors: *Waste water(Pollution), *Data collections, *Surat(India), Waste water disposal, Waste water treatment, Collection, Developing countries, Management, Daily, Characteristics, Quantity, Improvement.

Wastewater facilities of collection, treatment, and disposal in Surat, India were designed in 1946 and completed in 1957 for a prospective population of 0.3 million in 1976. Today the total population in the Municipal limits of Surat is about 0.6 million, and in the sewered area it is about 0.45 million. There are some places in the sewered ara of Surat which stink, including the wastewater treatment site. There are problems of over-flowing manholes, and waterlogging during the rainy season. This paper presents compiled data on the reasons for deficiencies in existing wastewater facilities and suggests methods to improve some of them. (Bell-Graf--Cornell)
W80-01647

AN IMMEDIATE MEANS OF URBAN WATER POLLUTION CONTROL IN DEVELOPING COUNTRIES,
Technische Hochschule, Darmstadt (Germany, F. R.). Inst. fuer Wasserversorgung, Abwasserbesitigung und Raumplanung.
K. Suwarnarat.
In: Water Pollution in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani & N. C. Thanh. Asian Institure of Technology, Bangkok, Thailand (Pergamon Press in USA), p 421-433, 1978. 9 Fig, 2 Tab, 11 Ref.

Descriptors: *Waste water treatment, *Treatment facilities, *Developing countries, Capital costs, Investment, Water pollution control, Urban development.

Rapid urbanization in developing countries has caused water pollution problems with which existing waste water treatment methods cannot adequately cope. This paper discusses the advantages and disadvantages of the on-site treatment system, and proposes its immediate application in developing countries to alleviate and combat urban water pollution. (Bell-Graf--Cornell)
W80-01649

REMOVAL OF MERCURY IN INDUSTRIAL WASTEWATER APPLICATION OF THIOUREA TYPE CHELATE RESIN,
Yokohama National Univ. (Japan). School of Engineering.
Y. Kobayashi, and M. Sugai.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 437-457, 1978. 14 Fig, 7 Tab, 15 REf.

Descriptors: *Industrial wastes, *Waste water treatment, *Mercury removal, *Chelating resin, *Experiments, Chemical properties, Effects, Adsorption, Anions, Oxidizing agent, Metallic ions, Heavy metals, Washings.

The problem of mercury removal from waste water has not been effectively solved by various known treatment methods. Studies were carried out on the application of a thiourea-type chelate resin as an alternative method; results obtained in the treatment of waste water containing mercury showed that the chelating resin method is superior in mercury removal from wastewater. (Bell-Graf--Cornell)
W80-01650

POLLUTION CONTROL THROUGH RECOVERY FROM WASTES AND EFFLUENT TREATMENT IN SYNTHETIC RESIN PROCESSING INDUSTRY,
Beck and Co. Ltd., Pimpri (India).
M. V. Vaidya.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology Bangkok, Thailand (Pergamon Press in USA), p 459-468, 1978. 4 Fig, 1 Tab, 2 Ref.

Descriptors: *Water pollution control, *Waste water treatment, *Treatment facilities, *Effluents, *Waste recovery, *Synthetic resin processing, *Waste salt filter cake, Industries, Industrial wastes, India, Developing countries, Evaluation, Low-cost alternatives, Irrigation, Lagooning.

The recovery of resin from polyester and epoxy resin production involving the use of locally available materials and technology in India as developed by Dr. Beck and Company is briefly reviewed and discussed. Treatment of the wastewater after resin recovery was evaluated using various low-cost alternatives such as irrigation and lagooning. (Bell-Graf--Cornell)
W80-01651

TREATMENT OF EFFLUENTS FROM TEXTILE FIBER PROCESSING INDUSTRIES,
Degremont S.A., Rueil-Malmaison (France).
J. M. Rovel.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 493-502, 1978. 1 Fig, 5 Tab.

Descriptors: *Waste water treatment, *Biological treatment, *Treatment facilities, *Efficiencies, *Textile processing, Pollutants, Effluents, Industries, Activated carbon, Treatment efficiency, Physico-chemical treatments, Purification processes, Tertiary treatment.

Despite the great variety of pollutants in the effluents of textile processing, the biological purification treatment by activated sludge remains the only process ensuring high efficiencies at acceptable costs, provided this treatment is adapted to the type of effluent to be treated. This is supported by plants already installed and in particular by the Barbry Cambron treatment unit described herein. To make the best of circumstances, tertiary treatments are available to improve the elimination of the color and residual COD. In this case, an economic study is necessary to determine whether or not granular activated carbon or oxidation by ozone will be applied. Finally, if emphasis is to be put upon water saving through recirculation, the use of submerged biological filtering beds could permit an interesting recirculation of the less polluted rinse water, which often represents 20 to 50% of the water consumed at the works. (Bell-Graf--Cornell)
W80-01653

PALM OIL WASTE TREATMENT BY AEROBIC PROCESS,
Singapore Univ., Dept. of Civil Engineering.
K. K. Chin.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 505-511, 1978. 2 Fig, 3 Tab, 5 Equ, 13 Ref.

Descriptors: *Waste water treatment, *Aerobic process, *Feasibility, *Palm oil, *Processing waste, Evaluation, Biochemical oxygen demand, Equations, Experiments, Color, Settling characteristics, Steady state, Biokinetic coefficients, COD.

The objective of this study was to determine the technical feasibility of treating crude palm oil processing waste by the aerobic treatment process. Biokinetic coefficients were evaluated and found to be not significantly different from pulp and paper, and other organic wastes of high BOD strength. The settling characteristics of the treated waste were significantly improved compared with its raw state. Overall, the aerobic systems studied proved to be effective in the removal of BOD and COD but not effective in color removal. (Bell-Graf--Cornell)
W80-01654

CASE STUDIES OF AGRO-INDUSTRIAL WASTEWATER POLLUTION CONTROL IN THAILAND,
Siam Technology Co. Ltd., Bangkok (Thailand).
R. J. Frankel, H. F. Ludwig, and C. Tongkasame.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 513-524, 1978. 1 Fig, 4 Ref.

Descriptors: *Water pollution control, *Industrial wastes, *Agro-industries, *Waste discharge, Waste water treatment, Treatment facilities, Factories, Standards, Food processing, Sugar cane, Pineapple canning, Fish processing, Receiving streams.

Thailand, as a major producer of agro-industrial exports, is experiencing increasing pollution problems from the discharge of food processing wastewaters into receiving streams. Licensing of new plants is now contingent upon prior government approval of proposed water systems. Unfortunately adoption of excessively strict standards has led to unenforceable situations. Case studies of three important agro-industries in Thailand are represented: cane sugar, pineapple canning and fish processing industries. This paper reviews typical waste discharges from these factories, the initial waste water treatment design, modifications which occurred as waste generation was reduced due to process change, and renewed interest in recirculation and reuse of waste by-products. (Bell-Graf--Cornell)
W80-01655

TREATMENT STUDIES OF PALM OIL MILL WASTE EFFLUENT,
Department of Chemistry (Malaysia).
S. Sinnappa.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 525-537, 1978. 2 Fig, 8 Tab, 5 Ref.

Descriptors: *Waste water treatment, *Agro-industries, *Water pollution control, *Biodegradation, *Malaysia, *Palm oil, Waste discharge, Effluents, Receiving waters, Standards, Experiments, Effects, Water resources.

The palm oil industry in Malaysia has grown rapidly to become one of the major revenue-earners for the country. However, the waste effluent produced from palm oil processing and its discharge into receiving streams and rivers have produced considerable damage to water resources. This paper describes a system of biodegradation procedures which enabled the resultant effluent to meet most requirements of the final standards proposed by the Division of the Environment. Details and results of the successful experimental studies are included. (Bell-Graf--Cornell)
W80-01656

STUDIES OF AN ANAEROBIC/AEROBIC TREATMENT PROCESS FOR A STRONG ORGANIC WASTE,

Monash Univ., Clayton (Australia). Dept. of Chemical Engineering.
G. A. Holder, G. J. Sewards, and P. H. Scott.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 539-549, 1978. 11 Fig, 3 Tab, 8 Equ, 5 Ref.

Descriptors: *Waste water treatment, *Aerobic treatment, *Anaerobic treatment, *Organic wastes, *Dairy whey, Design, Equations, Waste disposal, Estimating, Stability, Stability, Treatment processes, Treatment facilities, Methane, Cell synthesis, Cell wastage, Cell mass change, Net rate, Substrate removal, Growth rate constant, Metabolism.

The objective of these studies is to develop laboratory procedures and design equations for the decomposition of biologically-degradable strong organic wastes. The particular waste being used for the present studies is dairy whey. This is a useful material from the point of view of developing design procedures, since it is readily obtainable, strong, fairly uniform in composition, homogeneous (i.e., no suspended solids), and degrades both aerobically and anaerobically. It also presents a serious disposal problem in many countries. (Bell-Graf--Cornell)
W80-01657

OIL SEPARATION FROM OILY WASTEWATER BY INCLINED PLATES,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
N. C. Thanh, and U. Thipsuwan.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 553-565, 1978. 11 Fig, 1 Tab, 14 Ref.

Descriptors: *Waste water treatment, *Oil, *Oily waste water, *Gravity separation, *Separators, *Effects, *Performance, Improvement, Design, Experiments, Effluents, Contaminants, Temperature, Mineral oil, Oil refineries, Overflow rate, Oil concentrations, Hydrogen ion concentration.

Reviewed are the essential elements of gravity separation of oil from oily wastewater, the development of oil plate separators and the ensuing improvement in performance compared with the standard API separator. The design of a corrugated plastic separator is presented. The results of an experimental study on mineral-oil contaminated effluent at an oil refinery are presented for the effects of overflow rate, initial oil cncentrations, temperature and pH on the separator performance. Overflow rate and initial oil concentrations are evaluated for the optimum performance of the separator. To enhance the oil removal in the effluent, oily wastewater was heated and pH was adjusted to acid or basic side. (Bell-Graf--Cornell)
W80-01658

INDUSTRIAL WASTEWATER TREATMENT PROCESS USING GRANULAR ACTIVATED CARBON,
Yokohama National Univ. (Japan). Dept. of Safety and Environmental Engineering.
K. Urano, and V. Chanyasak.
In: Water Pollution Control in Developing Countries. Proceedings of the Intenational Conference, Bangkok, Thailand (Pergamon Press in USA), p 567-572, 1978. 2 Fig, 2 Tab, 3 Ref.

Descriptors: *Waste water treatment, *Adsorption, *Design, *Assessment, *Industrial wastes, *Feasibility, *Granular activated carbon, Organic pollutants, United States, Tertiary treatment, Standards, Water quality, Public health, Industrial applications, Domestic applications, Lab techniques.

This paper describes the application of granular activated carbon in the industrial wastewater treatment process. Many types of granular activated carbon for wastewater treatment are supplied by 10 companies in Japan. Design criteria such as space velocity, flow rate, configuration system and regeneration method of spent carbon are developed for four operation modes of the treatment process. There are about 140 industrial wastewater treatment plants using granular activated carbon, and many types of furnaces for the regeneration of spent carbon have also been developed in Japan. (Bell-Graf--Cornell)
W80-01659

USE OF GRANULAR ACTIVATED CARBON FOR TREATING INDUSTRIAL WASTEWATERS,
Calgon (Merck), Pittsburg, PA.
V. Wu.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 573-588, 1978. 6 Fig, 9 Tab, 2 Ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Adsorption, *Design, Industries, Evaluation, Biological treatment, Separation techniques.

Treatment of organic waste materials present in industrial and municipal wastewaters has been traditionally accomplished by combining liquid-solid separation techniques and biological processes. As an alternative, the technology of granular activated carbon adsorption has been applied to remove organic pollutants from wastewater. The reasons for the choice of activated carbon as an adsorbent are several-fold. Carbon has been demonstrated to have good sorption characteristics for most organic compounds. This paper describes the laboratory techniques and systems designs used in assessing the feasibility of granular activated carbon for a specific application. Examined also are case studies of industrial and domestic wastewater applications of activated carbon in the United States. (Bell-Graf--Cornell)
W80-01660

SIMULATION AND PROCESS DESIGN OF DEEP BED FILTRATION,
Syracuse Univ., NY. Dept. of Chemical Engineering and Materials Science.
C. Tien.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 589-595, 1978. 2 Fig, 18 Equ, 9 Ref.

Descriptors: *Simulation analysis, *Water treatment, *Deep bed filtration, *Filter coefficient, *Particle deposition, Estimating, Equations, Filters, Effects, Performance, Design, Flow rate.

The performance of a deep bed filter is characrerized by the quality of the filtrate it produces and the pressure drop across the bed necessary to maintain a constant flow rate. Based on recent theoretical advances, procedures for simulating the dynamic behavior of deep bed filtration are presented. The results of RAJAGOPALAN and TIEN (1976) are used for the estimation of the filter coefficient, and the effect of deposition on filter performance is analyzed on the basis of assumed deposit morphology. An example is given to demonstrate the method. (Bell-Graf--Cornell)
W80-01661

COMBINED TREATMENT WITH OZONE AND ACTIVATED CARBON,
Degremont S. A., Rueil-Malmaison (France).
Y. Richard, and L. Brener.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 607-615, 1978. 6 Fig, 1 Tab.

Descriptors: *Water treatment, *Ozone, *Activated carbon, *Industrial plants, Sand filtration, Clarification, Chloroform, Treatment line, Organic matter, Bacteria, Filters, Influents, Halogen derivatives, Raw water.

The condition for the use of ozone and activated carbon can now be specified on the basis of the first long test carried out at the industrial plant at Morsang-sur-Seine. Good results were obtained with a treatment which combines clarification with sand filtration followed by second stage through granular activated carbon. Results can be very appreciably improved by ozonation between the two stages of filtration. (Bell-Graff--Cornell)
W80-01663

A COMPARATIVE STUDY OF HIGH RATE BIOLOGICAL FILTERS,
Malaya Univ., Kuala Lumpur, (Malaysia). Dept. of Civil Engineering.
G. T. Tan.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 619-624, 1978. 1 Fig, 3 Tab, 2 Equ, 9 Ref.

Descriptors: *Waste water treatment, *Trickling filters, *Biological treatment, Plastic media, High rate filters, Pilot plant operation, Comparison.

A comparative study of high rate biological trickling filters was conducted using four types of plastic media viz. the two modular types (Floor and Surfpac), the random type (Filterpak) and the tubular type (Cloisonyl). Their BOD removal characteristics were fitted into a mathematical model following a first order kinetic reaction, Their fits being statistically highly significant. The overall results showed that Filterpak gave consistently better BOD removal performance. (Bell-Graf--Cornell)
W80-01664

PLASTICS MEDIA FOR TREATMENT OF INDUSTRIAL AND MUNICIPAL WASTEWATER,
Imperial Chemical Industries Ltd., Hyde (England).
M. L. Hemming, and J. Lunt.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 625-630, 1978. 1 Fig, 7 Ref.

Descriptors: *Waste water treatment, *Plastics media, *Treatment facilities, *Industrial wastes, *Municipal wastes, *Biological treatment, Design, Activated sludge, Costs, Effluents, Flotation, Removal efficiency, History, Mineral media filters, Palm oil.

This paper discusses the development of plastic media for biological treatment of waste waters and the characteristics of the media for different applications. It outlines the design parameters used for plants utilizing plastic media and the advantages and disadvantages of the system. Case histories of operational plants are then discussed both for industrial and municipal waste waters. Examples are considered where plastics media is used in combination with conventional biological systems such as activated sludge and mineral media filters. Examples are also quoted where plastics media may be used following flotation for the treatment of palm oil effluent. (Bell-Graf--Cornell)
W80-01665

DEODORISATION USING BIOLOGICAL TRICKLING FILTER,
Malaya Univ., Kuala Lumpur. (Malaysia). Dept. of Civil Engineering.
G. T. Tan.

In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 631-637, 1978. 2 Fig, 1 Tab, 4 Ref.

Descriptors: *Waste water treatment, *Trickling filters, *Biological treatment, *Deordorisation, Sewage, Biochemical oxygen demand, Hydraulic loading, Rock medium, Plastic medium.

Deodorisation of foul air from a sewage treatment plant using plastic and rock biological trickling filters was studied. Microbiological reaction is essential for deodorisation while chemical changes are insignificant. The optimum deodorising filter condition is related principally to the type of media, hydraulic and BOD loadings. At such conditions, the more sensitive rock filter is able to achieve satisfactory deodorisation with an air flow of less than 130 l/sm2. The plastic medium is able to do this only at higher hydraulic and BOD loadings permitting higher air flow. At comparative air and hydraulic flows, the rock filter is more effective for deodorising. (Bell-Graf--Cornell)
W80-01666

UPFLOW ANAEROBIC FILTER: A SIMPLE SEWAGE TREATMENT DEVICE,
National Environmental Engineering Research, Inst., Nagpur (India).
V. Raman, and A. N. Khan.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 639-649, 1978. 4 Fig, 4 Tab, 7 Ref.

Descriptors: *Waste water treatment, *Filtration media, *Surface waters, *Flow rate, Removal efficiency, Treatment efficiency, Head loss, Projects, Reservoirs, Malaysia.

The upflow anaerobic filter can be used successfully as a simple secondary treatment device for treating septic tank effluent and settled domestic sewage, or used as a composite sewage treatment unit. The filter consists of stone media of size 1.9 cms to 2.5 cms filled to a depth of 75 cms to 120 cms with the flow from bottom to top, operating at a hydraulic rate approximating to that of a low rate trickling filter. Studies show an average removal of 70 to 80 per cent of applied BOD and complete removal of helminthic ova in the filters serving as secondary treatment units. They are simple to construct, operate at low head loss, and are relatively free from nusiance. These may get clogged up after 1 1/2 to 2 years of continuous operation, but occasional flushing by water from the top can prolong their life. (Bell-Graf--Cornell)
W80-01667

OPTIMAL FLOW PATTERNS IN ACTIVATED SLUDGE PROCESS,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
E. A. R. Ouano, and M. G. Dissanayake.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 661-668, 1978. 3 Fig, 1 Tab, 6 Equ, 12 Ref.

Descriptors: *Waste water treatment, *Activated sludge, *Flow patterns, *Dispersed growth reactor, *Autocatalytic nature, Equations, Substrate concentration, Sucrose, Recycle sludge concentration, Efficienceis, Reactor volume, Optimal.

Analyzed is the autocatalytic nature of substrate degradation and microbial growth in activated sludge process; examined are the optimal mixing flow patterns to yield the best effluent quality. When using a sucrose based substrate, the completely mixed activated sludge was found to be superior to the conventional or plug flow activated sludge if the desired removal efficiency is less than 91%. The two processes have very little differences between 91% to 97% removal efficiency, whereas the plug flow process has the advantage above 97% removal efficiency. Since most activated sludge processes are operated with substrate removal efficiencies between 90-98%, the superiority of one process over the other is not very well defined resulting in different conflicting claims. (Bell-Graf--Cornell)
W80-01668

DEEP TANK AERATION-FLOTATION FOR BIOLOGICAL PROCESSING,
Idaho Univ., Moscow. Dept. of Chemical Engineering.
M. L. Jackson.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 669-674, 1978. 7 Equ, 10 Ref.

Descriptors: *Waste water treatment, *Design, *Aeration-flotation, *Deep tank fermentation system, *Dispersed growth reactor, *Biological processing, Economics, Paper mills, Biological sludge growth, Potato processing wastes, Single cell protein, Solids separation, Dissolved gas, Sulfite pulp mills, Oxygen, Equations.

Deep tank fermentation systems offer advantages of low air requirements, little mechanical equipment, small land space, and lower capital needs. Air input to meet oxygen demand can be predicted from design equations developed. The economics and design for applications are summarized by three examples: reduction of a waste water from a paper mill, growth of a biological sludge on a diluted sulfite waste liquor, and growth of single cell protein on potato waste solubles. The combination of the deep tank biological reactor and solids separation, using the inherent dissolved gas for flotation, effects a net reduction in energy requirements for overall processing. The high oxygen partial pressure at the bottom of a tall tank appears to offer some of the advantages claimed for the high purity oxygen process. (Bell-Graf--Cornell)
W80-01669

A MECHANISM FOR BIOLOGICAL DENITRIFICATION IN AERATED LAGOON SYSTEM,
Morinaga Milk Industry Co. Ltd., Tokyo (Japan). Central Research Lab.
K. Okada, K. Ogasa, K. Yamamoto, and N. Ishibashi.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 675-680, 1978. 5 Fig, 2 Tab, 5 Ref.

Descriptors: *Waste water treatment, *Oxygen, *Effects, *Experiments, *Aerated lagoons, *Biological denitrification, Activated sludge, Aerobic conditions, Nitrous oxide, Nitrogen, Performance pattern, Treatment facilities.

This paper examines the influence of oxygen on the process of denitrification with both isolated denitrifying bacteria and activated sludge to elucidate the mechanism of biological denitrification in the aerated lagoon system under aerobic conditions. Based on experimental results, two mechanisms are presented. The first is the denitrificarion process whereby the terminal product is nitrous oxide. Denitrifying bacteria reduces nitrate to nitrous oxide gas under high oxygen concentration levels. One possible mechanism of this aerobic denitrification was hypothesized as denitrification due to nitrous oxide gas formation. In the other denitrification process, the terminal product is nitrogen gas. In the case of activated sludge, nitrate was reduced to nitrogen gas even under high oxygen concentration levels. Nitrogen gas formation by activated sludge appeared to be dependent on the activity of denitrifying bacteria and floc size of sludge. So, this denitrification due to nitrogen gas formation by sludge could be caused by the existence of anaerobic regions in activated sludge. (Bell-Graf--Cornell)
W80-01670

COMPARISON AND SELECTION OF RATIONAL-BIOLOGICAL-TREATMENT PROCESS FOR HANDLING CARBOHYDRATE WASTEWATER,
Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.
P. Y. Yang, and M. F. Kong.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lonani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 681-693, 1978. 7 Fig, 5 Tab, 1 Equ, 17 Ref.

Descriptors: *Waste water treatment, *Comparison, *Biological treatment, *Carbohydrates, Performance, Equations, Treatment facilities, Trickling filters, Anaerobic, Removal efficiency, Organic loading rate, Solid retention time, Activated sludge.

The concepts of solid retention time (SRT) and organic loading rate were used as the basic parameters in the comparison of process performances, such as COD removal efficiency, sludge production and sludge volume index (SVI). Synthetic sucrose wastewater was used in operation of the laboratory pilot plant. It was found that the activated sludge process had the highest COD removal efficiency (79 to 95%) while the trickling filter had the lowest sludge production (0.034 to 0.683 kg/m cu/day) and SVI (10 to 52.6) within the organic loading of 0.226 to 5.6 kg COD/m cu/day and the SRT ranging from 2 to 23.8 days. Based on the present study, a decision to select a treatment process, both trickling filter and anaerobic contact processes could possibly be used. When high effluent quality was required, activated sludge process was shown to be pertinent to single secondary treatment. As a tertiary treatment process, the trickling filter process was found to be technically and economically suitable. (Bell-Graf--Cornell)
W80-01671

MICROBIAL TREATMENT AND UTILIZATION OF NIGHTSOIL,
Taiwan Inst. of Environmental Sanitation, Taipei.
M. C. Lo.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lonani & Thanh. Asian Institute of Technology, Bangkok, Thailand, (Pergamon Press in USA) p 701-707, 1978. 1 Fig, 3 Tab.

Descriptors: *Sludge, *Microbial treatment, *Nightsoil, *Chlorella, *Anaerobic digestion, *Aerobic digestion, Trickling filters, Pretreatment, Optimum control, Winter, Summer, Chicken feed, Eggs, Activated sludge.

This study is divided into two stages. The first stage deals with the efficiency of nightsoil treatment with photosynthetic bacteria (P.S.B.) and chlorella. The duration of nightsoil treatment with PSB and chlorella proved to be 20 days faster than the traditional activated sludge or trickling filter method, and 10 days faster than the aerobic digestion method. Furthermore, much less sludge was produced. The second stage concerns the comparison of the by-product 'chlorella for chicken feed' with ordinary commercialized feed. In meat chicken it saved 14-20% in cost; in layer chicken 18.16%; in egg production 16.29%; and in egg weight, 4.9% more than that of average eggs. (Bell-Graf--Cornell)
W80-01673

THE DESIGN AND SELECTION OF MECHANICAL AERATION DEVICES,
Lightnin Mixer Pty Ltd., Camberwell (Australia).

J. A. Shaw.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & C.N. Thanh. Asian Institute of Technology, Bangkok, Thailand, (Pergamon Press in USA), p 709-722, 1978. 13 Fig.

Descriptors: *Design, *Mechanical aeration, *Aerators, *Activated sludge, *Biological treatment, *Mixing, Waste water treatment, Performance criteria, Circle of influence, Basin depth, Energy relationships, Continuous flow basin dynamics, Impeller synergism, Equations, Cyclic changes, Mixed lagoons.

Mechanical aerators have been developed as a cost effective replacement for traditional diffused air aeration. They include aerators of several types--high or low speed surface, submerged turbine, combined submerged and surface, and draft tube. Each type has certain strengths and weaknesses. This equipment has two functions--aeration and mixing. Proper consideration of the mixing function is an essential part of aeration system design. Design for the aeration function must be related to the actual tests conducted on the aerator under standard conditions. But recent work has revealed serious defects in the traditional aerator test method. More refined test procedures have disclosed the importance of parameters which had previously been overlooked. Mechanical design of aeration equipment is more demanding than popularly supposed. In addition to impellers, shafts and shaft support systems speed reducer type, design and ratings are of critical importance. The design of both fixed and floating platforms also requires careful consideration of certain factors. Mechanical aerators have wide application in Asian countries for major plants, simple ponds for small communities as a key element in integrated modular treatment plants. (Bell-Graf--Cornell)
W80-01674

THE IMPROVEMENT OF THE PERFORMANCE OF THE PURIFICATION OF MUNICIPAL AND INDUSTRIAL SEWAGE WATER WITH COAGULANTS AND FLOCCULANTS,
Chemische Fabrik Stockhausen and Cie., Praestol-Marken (Germany, F.R.).
I. Reuter.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E. A. R. Ouano, B. N. Lohani & N. C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 723-727, 1978. 1 Fig, 1 Tab.

Descriptors: *Waste water treatment, *Purification, *Performance, *Municipal wastes, *Industrial wastes, *Coagulants, *Flocculation, Kinetics, Structure, Sludge, Dewatering.

Chemical coagulation and flocculation were applied to industrial and municipal wastewater to improve the overall treatment efficiency. Ferrous sulfate and aluminum sulfate at a dose of 100 mg/l could yield favorable results when each was used together with 1 mg/l of polymer. More than twice reduction of BOD and COD was achieved and better sludge dewatering efficiency was also obtained. (Bell-Graf--Cornell)
W80-01675

APPROPRIATE WASTE TREATMENT FOR TROPICAL CLIMATES: A STATE-OF-THE-ART REVIEW,
McGill Univ., Montreal (Quebec).
W. Rybczynski, C. Polprasert, and M. McGarry.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 735-742, 1978. 36 Ref.

Descriptors: *Waste treatment, *Tropical climates, *Technology, *Literature reviews, *Water supply, *Waste disposal, *Developing countries, Information sources, Review coverage, Composting, Reuse, Stabilization ponds, Projects.

This paper is a condensed version of part of a study that has recently been completed at the International Development Research Centre in Ottawa (RYBCZYNSKI et al., 1977). The aim of this project was to identify, through a review of the technical literature, the options that are available for waste treatment in tropical climates, and particularly for less-developed countries in those regions. This technology review has been conducted by IDRC, but it is also the first phase in a major research project of the World Bank dealing with appropriate technologies for water supply and waste disposal. (Bell-Graf--Cornell)
W80-01677

SUCCESSION OF ORGANISMS IN THREE-STAGE SEWAGE PONDS,
Institute of Meteorology and Water Management, Krakow (Poland).
For primary bibliographic entry see Field 5C.
W80-01754

THE COMPARABILITY OF OXYGENATION AND EFFICIENCY MEASUREMENTS,
Stuttgart Univ. (Germany, F.R.). Inst. fuer Siedlungswasserbau und Wasserguetewirtschaft.
F. Bingel.
Progress in Water Technology, Vol 11, No 3, p 89-99, 1979. 5 Fig, 1 Tab, 8 Ref.

Descriptors: *Oxygenation, *Aeration, *Laboratory tests, Measurement, Dissolved oxygen, Water temperature, Waste water treatment, Sewage treatment, Diffusion, Mixing, Oxygen, Air, Water treatment, Oxygenation capacity, Oxygenation efficiency.

Oxygenation capacity and efficiency measurements have a decisive influence on the performance and economy in planning and selecting an aeration system. The comparison of guaranteed values and controlled measurements well as the final appreciation of guaranteed values indicates important errors and obscurities, not only in the carrying out of experiments but also in their evaluation. Presented was a method designed to eliminate the errors which were described individually. (Sims-ISWS)
W80-01845

ON THE REOXYGENATION EFFICIENCY OF DIFFUSED AIR AERATION,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Hydromechanik.
For primary bibliographic entry see Field 5G.
W80-01846

DIMENSIONLESS ANALYSIS OF CIRCULATION, MIXING AND OXYGENATION IN AERATION TANKS,
Technical Univ. of Denmark, Copenhagen. Dept. of Sanitary Engineering.
P. Harremoes.
Progress in Water Technology, Vol 11, No 3, p 49-57, 1979. 5 Fig, 5 Tab, 13 Ref.

Descriptors: *Aerobic treatment, *Sewage treatment, *Aerated lagoons, *Tanks, Laboratory tests, Model studies, Mathematical models, Diffusion, Mixing, Circulation, Velocity, Oxygen, Dissolved oxygen, Air, Oxygenation, Aeration, Waste treatment, Water treatment.

The rising plume of mixed air and water in an aeration basin was treated by analogy with the theory of a bouyant jet. It was shown that the characteristic velocity of the plume is (g Q sub o) to the 1/3 power, where g is the acceleration of gravity and Q sub o is supply of air per unit length of the aeration basin. The total circulation and the velocity at the bottom can be related directly to the characteristic velocity. This was shown by comparison with data from laboratory scale (40 cm) to full scale (4 m). The longitudinal dispersion in aeration basins was related to the Reynold's number for the rotational flow with the same characteristic velocity. Dimensionless analysis of data revealed that the longitudinal dispersion is related to the supply of air as D sub L related to (Q sub o) to the 0.42 power. The aeration capacity was related to geometry, the Froude number of the circulation, and the relative size of holes in the diffuser. However, analysis of model and full-scale data showed scale effects not yet accounted for. (Sims-ISWS)
W80-01847

RUNOFF CONTROL COMPARISONS FOR COMMERCIAL BEEF CATTLE FEEDLOTS,
Science and Education Administration, Lincoln, NE.
For primary bibliographic entry see Field 5G.
W80-01851

GRADATION OF GRANULAR MEDIA BY VOLUME,
Iowa State Univ., Ames. Dept. of Civil Engineering.
J. C. Young, and J. E. Wiskus.
Journals of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Technical Note, p 1011-1014, October 1979. 1 Tab, 1 Ref.

Descriptors: *Porous media, *Particle size, *Gradation, *Volumetric analysis, Analytical techniques, Methodology, Distribution, Filters, Measurement, Sands, Silica, Coals, Grain-size distribution.

This paper described a volumetric test procedure proposed to determine grain-size distribution of media used in water and wastewater filters. Laboratory test comparisons showed that measurement of size and gradation of granular media by volume rather than weight fractions provides a simple and rapid, yet accurate, method particularly suited to field use. Most specifications for media include a range such as 1.2 mm to 1.4 mm effective size with a uniformity coefficient less than 1.7. The volumetric method is sufficiently accurate to determine if media meet specifications. In borderline cases, more accurate weight measurements can be made. (Humphreys-ISWS)
W80-01858

CALCULATING OVERFLOWS FROM COMBINED SEWER SYSTEMS,
Black and Veatch, Kansas City, MO.
K. E. Larson.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Proceedings Paper 14883, p 829-842, October 1979. 14 Fig, 3 Tab, 13 Ref, 2 Append.

Descriptors: *Sewers, *Combined sewers, *Overflow, *Model studies, Mathematical models, Precipitation(Atmospheric), Runoff, Storm runoff, Rainfall, Water pollution, Water pollution sources, Storage, Sewage treatment, Excessive precipitation, Precipitation excess, Statistical analysis, Analytical techniques, *Detroit(MI).

Determining annual overflows from combined sewers is essential for evaluating overflow impact on receiving waters. A statistical methodology was developed based on acceptable hydrologic principles and correlating data with a neighboring combined sewer district. Calculation begins with estimating the average annual set of rainfall events. These are converted into the average annual set of rainfall excesses by applying an infiltration index to previous areas and a depression storage value to impervious areas. For this calculation, rainfall excess can go to system storage, flow to the treatment plant, or overflow to natural water courses. The sum of overflows resulting from calculations on each of the 152 annual occurrences is the average annual value of overflow. The calculated values, correlated with the neighboring district, were within 2% of those observed when comparing average annual rainfall excess, flow to treatment plant, and overflows. (Sims-ISWS)
W80-01862

CONTINUOUSLY OPERATED LIQUID-SOLIDS SEPARATOR,
National Petro Chemicals Corp., New York. (Assignee).

G. Romano, and M. A. Rismondo.
U.S. Patent No 4,163,723, 8 p, 6 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 150, August 7, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Suspended solids, Resins, Water purification, Equipment.

The invention relates to an apparatus or separator for continuously separating a powered resin material, such as finely-divided high-density polyethylene particles, which is suspended in water and supplied to the separator as an infeed slurry, by permitting the resin, which is of a lower specific gravity than the water, to float upwardly within a vessel where it is withdrawn as a thickened slurry through an outlet orifice located in the upper portion of the vessel. The infeed slurry is fed into the lower central section of the vessel, and an outlet orifice for clarified water is provided in the base portion. Anti-swirl baffles in the form of vertically extending plate members are located in circumferentially spaced relationship inside the vessel in the upper regions in order to restrict the undue agitation and swirling of the resinous material and limit resultant downward movement. Agitation is imparted to the thickened slurry in the uppermost region of the vessel through a suitable rotatable impeller mounted in the upper section of the vessel at a level below the outlet orifice in order to maintain the accumulated resin uniformly dispersed as it is being withdrawn from the separator. (Sinha-OEIS)
W80-01934

APPARATUS FOR THE BIOLOGICAL PURIFICATION OF WASTE WATER,
PEC Process Engineering Co., S.A., Maennedorf (Switzerland). (Assignee).
H. Mueller.
U.S. Patent No 4,163,720, 7 p, 4 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 148, August 7, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Organic wastes, Biological treatment, Aeration, Aerobic treatment, Anaerobic conditions, Equipment.

An apparatus is provided for the multistage biological purification of waste water containing organic substances including carbohydrates and proteins. The apparatus comprises a substantially closed first tank for holding waste water while maintaining the waste water free from contact with air so as to prevent further oxygen from becoming dissolved in the waste water. The apparatus also includes a second tank including an aerator for dissolving oxygen in waste water. The second tank is located inside the first tank and includes a conical bottom portion for receiving sludge produced by aerobic degradation of the waste water in the second tank. (Sinha-OEIS)
W80-01935

PROCESS FOR THE PURIFICATION OF CONTAMINATED WATER,
Feltex Ltd., (South Africa). (Assignee).
R. H. Turnbull.
U.S. Patent No 4,163,716, 5 p, 1 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 147, August 7, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Dyes, Ion exchange, Electrolysis, Separation techniques, Color, Heavy metals.

The invention concerns a process for the purification of acid dyehouse effluent from a dyeing process, which is contaminated with coloured substances and heavy metal ions. After removal of fibers, the effluent is subjected to ion exchange to remove surface active agents and is then subjected to electrolysis with an iron cathode. Ferrous and ferric hydroxide is formed and the ferrous and ferric hydroxide together with the colored substances and heavy metal ions are removed from the effluent liquid. The liquid which remains is recycled to the dyehouse. (Sinha-OEIS)
W80-01937

METHOD FOR TREATMENT OF WASTE WATER,
Agency of Industrial Science and Technology, Tokyo (Japan). (Assignee); and Sumitomo Jukikai Envirotech, Inc., Tokyo (Japan). (Assignee).
Y. Ikari, S. Yokoyama, and K. Katoh.
U.S. Patent No 4,163,715, 6 p, 1 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 146-147, August 7, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Color, Chemical oxygen demand, Adsorption, Separation techniques, Inorganic compounds.

In removing color components and COD components from waste water, the waste water is treated with an inorganic adsorbent such as magnesia adsorbent. The mixture of the adsorbent and waste water thus obtained as subjected to a sedimentation treatment to separate the adsorbent as a slurry layer from a water layer. A portion of the adsorbent slurry is returned to the adsorption step. The remainder of slurry is transferred to a dehydration step. Water separated at the sedimentation step can be directly discharged since the color and COD value are very low. However, sometimes a little solid matter mainly composed of fine inorganic adsorbent may be contained in the water. In such a case, further treatment such as coagulation treatment or activated sludge treatment may be conducted. (Sinha-OEIS)
W80-01938

SEWAGE DISPOSAL SYSTEM,
A. A. Monson.
U.S. Patent No 4,162,976, 9 p, 5 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 5, p 1197, July 31, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Waste disposal, Evaporation, Anaerobic conditions.

A four stage sewage disposal system is described in which sewage from residential or commercial buildings is received in an underground tank assembly. The system receives and completely destroys waste solids biochemically and disposes of the effluent by total evaporation within a sealed dispersion reservoir surrounding the two stage tank assembly. Raw sewage is reduced in first and second stages of anaerobic digestion in upper and lower tank units of the double tank assembly. Liquid effluent is forced outward through discharge openings in the lower tank unit and upward through a rock bed in the dispersion reservoir under the pressure of a liquid column in the upper tank unit. The liquid effluent evaporates in the rock bed as the third stage of disposal, with the resulting vapors being filtered through a sand bed over the rock bed and dispersed to the atmosphere in a fourth and final stage. (Sinha-OEIS)
W80-01941

WATER POLISHING SYSTEM,
AFL Industries, Inc., Chicago, IL. (Assignee).
W. M. Lynch.
U.S. Patent No 4,162,973, 12 p, 7 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 984, No 5, p 1196, July 31, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Separation techniques, Suspended solids, Oily water, Filtration, Coalescence, Water reuse, Modular units.

Waste water containing pollutants such as suspended solids and emulsified oil is pumped continuously through a self-contained separating or polishing system utilizing a simplified plug-in module to remove the pollutants. The suspended solids are removed by mechanical filtration and the emulsified oil is separated by coalescing oil into floatable droplets which can be skimmed from a water surface and withdrawn for external accumulation. The treated waste water may be returned for further use or pumped to other facilities for further treatment. (Sinha-OEIS)
W80-01942

REMOVING PHENOLS FROM WASTE WATER,
Metallgesellschaft A.G., Frankfurt am Main (Germany, F.R.). (Assignee).
P. Wiesner, and H-M. Stonner.
U.S. Patent No 4,172,902, 4 p, 1 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 5, p 1175, July 31, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Phenols, Separation techniques, Solvent extractions, Carbon dioxide, Hydrogen sulfide, Ammonia, Coal gasification.

A process for removing phenols from waste water resulting from the gasification or carbonization of coal and containing C02, and H2S and NH3, comprises mixing the waste water with a low-boiling organic solvent, separating the mixture into a solvent layer and an aqueous layer, stripping off from the aqueous layer under superatmospheric pressure the vapors of C02, H2S and organic solvent, then stripping off from the aqueous layer the NH3, leaving a refined aqueous product layer suitable for discharge. The stripped vapors are scrubbed under superatmospheric presssure with a portion of the cold refined product to remove organic solvent. Part of the solvent is condensed and separated under superatmospheric pressure. The remaining acid gases still containing ammonia and solvent are scrubbed with recirculated cooled raw phenol to remove the ammonia and solvent. (Sinha-OEIS)
W80-01944

WATER REUSE SYSTEM,
G. L. McCormick.
U.S. Patent No 4,162,218, 8 p, 2 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 984, No 4, p 936, July 24, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water reuse, Domestic wastes, Domestic water, Filtration, Water storage, Storage tanks, Gray water.

A used water reuse system includes a gray water holding tank to which gray water is supplied up to a maximum level through a filter and gray water drain line. Gray water sources such as kitchen and bathroom sinks, clothes and dishwashers, tubs and showers, and the like have drains connected through valves to the gray water drain line and to a conventional sewer line. Gray water is transferred, upon demand, from the gray water holding tank to noncritical water use devices, such as a toilet tank, for reuse and subsequent discarding. A sensor detects achievement of a maximum level in the gray water holding tank and causes the valves at the gray water sources to disconnect the latter from the gray water drain line, so as to discard any further gray water from the sources to the sewer line, and also closes a fail-safe valve to preclude flow from the gray water line to the gray water holding tank. Upon reduction of tank water level the sensor reopens the valves. A further sensor notes draining of the tank to a preselected minimum level for admitting fresh water. (Sinha-OEIS)
W80-01945

BIOLOGICAL TESTING DEVICE AND METHOD OF MEASURING TOXICITY OF SEWAGE,
Aktiebolaget Kalle-Regulatorer, Saffle (Sweden). (Assignee).
P. Solyom, B. Boman, and H. Bjorndal.
U.S. Patent No 4,162,195, 10 p, 7 Fig, 1 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 930, July 24, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Sampling, On-site tests, Toxicity, Biological treatment, Aeration, Oxygen demand.

To test sewage for the possible presence of substance which are toxic with respect to sewage biological purification microorganisms, a sample of the sewage is positively provided with a dissolved oxygen content and is then subjected to the action of microorganisms in a biological mass competely submerged in the sample. The volume of the biological mass is controlled to keep it at a constant level. Thereafter the oxygen content of the sample is measured, and if this content is found to be high, it is known that the sample contains toxic substances and that the sewage sample should be treated otherwise than biologically. (Sinha-OEIS)
W80-01946

APPARATUS FOR TREATING EFFLUENTS,
Krupp-Koppers G.m.b.H., Essen (Germany, F.R.). (Assignee).
W. Haverkamp.
U.S. Patent No 4,162,147, 6 p, 3 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 984, No 4, p 916, July 24, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial waste, *Water pollution treatment, Aeration, Flow, Equipment, Nozzles.

An aparatus for removing harmful substances from effluents has two chambers located symmetrically at opposite sides of an effluent channel. Each chamber contains two or more stacked trays which are each provided with a spiral path descending from a tray inlet to a tray outlet. All tray inlets are so located in the channel that substantially all effluent flowing in the channel is compelled to enter them and to travel by gravity through the respective tray. Air, an inert gas or a mixture of both is bubbled from below through the effluent flowing in the trays to expel and entrain the harmful substances. The treated effluent is then discharged back into the channel at locations downstream of its point of admission into the inlets. (Sinha-OEIS)
W80-01947

PROCESS FOR THE REMOVAL OF METALS FROM SOLUTION,
Louvain Research and Development VZW (Belgium).
A. E. J. Cremers, A. P. A. Maes, and P. G. L. Piegneur.
U.S. Patent No 4,167,481, 7 p, 9 Ref; Official Gazette of the United States Patent Office, Vol 986, No 2, p 412, September 11, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Separation techniques, Metals, Cation exchange, Polymers, Clay minerals, Adsorption.

Several metal ions, such as mercury, cadmium, copper, zinc, nickel and cobalt, may be removed from waste waters and similar solutions by treating such solutions with a cation exchanger in the presence of a polyamine. A treatment with clay minerals such as bentonite or montmorillonite in the presence of tetraethylenepentamine is preferred. The solution may be first combined with polyamine and then contracted with the cation exchanger, but in a preferred embodiment, the polyamine and cation exchanger are combined first to form a solid adsorbent and then contacted with the solution. (Sinha-OEIS)
W80-01948

PROCESS FOR PURIFYING WASTE WATERS,
F. Besik.
U.S. Patent No 4,167,479, 14 p, 5 Fig, 3 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 986, No 2, p 411, September 11, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Oxygen, Chemical reactions, Chemical precipitation, Biodegradation, Phosphates, Denitrification.

A purification process for the removal of biodegradable suspended and dissolved organic solids, nitrogenous compounds and phosphates from contaminated water by biological and chemical reactions is carried out simultaneously in active media of a biological waste treatment reaction system. The process comprises adding a finely divided mineral or mixture of minerals to the reaction system. Various levels of oxygen in the system are maintained to provide for biological oxidation of organic compounds and biological nitrification of nitrogen containing compounds and subsequent biological denitrification of the formed nitrites and nitrates. The selection of the mineral is such that through its dissociation in the system, the released metal ions are capable of precipitating a portion of ionic species, particularly phosphates present in the processed waste water, at the operating pH range of 6 to 8. The surfaces of the mineral attract microorganisms and suspended solids to facilitate and enhance simultaneously occurring biological and chemical reactions. (Sinha-OEIS)
W80-01958

SINGLE STAGE PROCESS FOR CONTINUOUS INTRODUCTION OF OXYGEN-CONTAINING GASES INTO EFFLUENT CONTAINING ACTIVATED SLUDGE,
Bayer A.G., Leverkusen (Germany, F.R.). (Assignee).
M. Zlokarnik, H. Guth, and T. Mann.
U.S. Patent No. 4,166,790, 7 p, 2 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 986, No 1, p 169, September 4, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Activated sludge, Oxygen, Equipment, Nozzles, Gases.

In a process and apparatus for the continuous introduction of air or oxygen-containing gases into an effluent containing activated sludge, the oxygen-containing gas is largely consumed by the effluent in a single absorption stage. The process introduces the gas through a plurality of gas inlets into a basin under its own hydrostatic pressure of a least 0.9 bar. The gas pressure of the gas introduced is about 0.01 to 0.5 bar above the hydrostatic pressure prevailing at the inlet. The individual gas inlets are separated by a distance of about 0.5 meter, as measured from the middle point of the gas inlet. The gas inlets may be nozzles, ejectors or apertured plates prefereably spaced equidistantly from one another and each may be supplied with propulsion liquid comprising effluent containing activated sludge. Preferred ranges from the various parameters depend upon whether the gas introduced contains more or less than 50% by volume of oxygen. Special gas injectors are also provided. (Sinha - OEIS)
W80-01967

IRRIGATED FIELDS FOR URBAN SEWAGE,
For primary bibliographic entry see Field 5E.
W80-01986

METHOD AND AN APPARATUS FOR PREVENTING DEPOSITS IN A PROCESS WATER SYSTEM FOR A GAS GENERATOR PLANT OR THE LIKE,
Motala Verkstad (Sweden). (Assignee).
H. E. Sundqvist.
U.S. Patent No. 4,166,499, 7 p, 8 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 986, No 1, p 78, September 4, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial water, *Separation techniques, Evaporation, Water vapor, Gases, Water pressure, Water reuse.

The invention is applicable to gas generator plants in which waste, such as garbage, bark and sewage sedimentation sludge is gasified and burned and the potential heat content of the waste is utilized in an economically favorable manner while at the same time, hydrocarbons such as phenols dissolved in water separated from the waste are prevented from being discharged to the surroundings. It has been suggested that the water soluble compounds should be refluxed to the gas generator together with water condensed on cooling. However, on the formation of vapor, the particles dissolved in the process water are precipitated and deposited on the walls, etc. of the conducting system. The object of this invention is to prevent deposits in a process water system for a gas generator plant of that kind. The plant has a pressure controlling means in the conduits for the process water connected to the heat exchanger. This pressure controlling means may consist of a pressure increasing means in the supply conduit for the process water or a pressure decreasing means in the return conduit for the process water. (Sinha-OEIS)
W80-01988

PROCESS FOR THE SEPARATION OF POLYVINYL ALCOHOL FROM AQUEOUS SOLUTIONS,
Hoechst A.G., Frankfurt am Main (Germany, F.R.). (Assignee).
W. Zimmermann, and H. Schindler.
U.S. Patent No. 4,166,033, 5 p, 2 Ref; Official Gazette of the United States Patent Office, Vol 985, No 4, p 953, August 28, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Hydrogen ion concentration, Chemical precipitation, Alkaline earth metals, Polyvinyl alcohol(PVAL).

Although Polyvinyl alcohol (PVAL) has no noxious effect on either plants or animals, it increases the chemical oxygen demand (COD) and the biological oxygen demand (BOD) of the waste water, and thus causes an undesirable environmental strain. This invention relates to a process for the separation of PVAL from an aqueous solution by precipitation of the PVAL in the presence of orthoborate ions and alkaline earth metal ions, in an alkaline medium, which comprises either adding first a saturated boric acid solution to the polyvinyl alcohol solution and then adjusting the latter one to a pH above 8 by means of an alklaline earth metal hydroxide solution; or adjusting first the polyvinyl alcohol solution to a pH of 11 by adding an alkaline earth metal hydroxide solution and then adding a boric acid solution neutralized by an alkaline earth metal hydroxide; and subsequently separating the precipitated polyvinyl alcohol. (Sinha-OEIS)
W80-01999

5E. Ultimate Disposal Of Wastes

ENERGY AND USEFUL BY-PRODUCT RECOVERY FROM ANIMAL WASTES,
Food and Agriculture Organization of the United Nations, Malaya (Singapore).
For primary bibliographic entry see Field 5D.
W80-01639

SOME PUBLIC HEALTH ASPECTS OF LEACHATE FROM LANDFILLS,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
C. Polprasert, and D. A. Carlson.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bankok, Thailand (Pergamon Press in USA), p 729-734, 1978. 1 Tab, 23 Ref.

Descriptors: *Public health, *Leachate, *Sanitary landfills, *Environmental effects, Waste disposal, Surface waters, Groundwater, Collection, Treatment, Physial aspects, Chemical composition, Pollution.

Leachate generated from sanitary landfills could become a potential source of environmental pollution both chemically and biologically. Evidences of surface and ground water contamination by leachate have been indicated in the literature. Most microorganisms present in the leachate were found to be in the growth inhibitory stage but they could reactivate again if entrance was gained into a more favorable environment and sufficient time was available to overcome their inhibitions to growth. A proper collection and treatment of landfill lea-

chate is recommended prior to its final disposal to the environment. (Bell-Graf--Cornell)
W80-01676

APPROPRIATE WASTE TREATMENT FOR TROPICAL CLIMATES: A STATE-OF-THE-ART REVIEW,
McGill Univ., Montreal (Quebec).
For primary bibliographic entry see Field 5D.
W80-01677

A MASS BALANCE STUDY OF APPLICATION OF MUNICIPAL WASTE WATER TO FORESTS IN MICHIGAN,
Michigan State Univ., East Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 5B.
W80-01875

SEWAGE DISPOSAL SYSTEM,
For primary bibliographic entry see Field 5D.
W80-01941

IRRIGATED FIELDS FOR URBAN SEWAGE,
J. Wierzbicki.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 305, Price codes: A02 in paper copy, A01 in microfiche. U.S. Army Corps of Engineers, Draft Translation 653, 1977, 8 p, 3 Fig, 3 Tab. Translated from Gaz woda i technika sanitarna, Vol 26, No 2, p 34-37, 1952.

Descriptors: *Sewerage, *Sewage treatment, *Sewage disposal, *Agriculture, *Irrigation, Sewage, Municipal wastes, Poland, Waste waters, Waste disposal, Pipelines, Percolation, Gravity, Flow, Treatment facilities.

A city in Lower Silesia, Poland, overcame difficulties in conducting urban sewage to a treatment plant by constructing a plant close to the city bypassing a nearby hill. Irrigation fields drain effluent flow and water is then conducted by a 2.3 km ditch to a stram 6.5 kr from the city. The city is located in slightly rolling terrain and no river or valley crosses the developed area. Another Polish city, Bydgoszcz used to pump it sewage water to fields 3.5 and five km away, with a 70 m manometric pumping height. Urban sewage, diluted by four artesian wells, averages 1100 cu m/d or 100 l/d/inhabitant. Because gravity sewage flow to a sewage treatment plant lowers community costs, this method was explored after buildings were destroyed during World War II. By conducting sewage water to irrigation fields by gravitational flow and constructing the treatment plant outside the city, costs were 30% of solely cnstructing a new system inside the city. Irrigation field soil was poor and sandy. Content or raw humus, phosphorus compounds, and potassium has favorably changed because of sewage irrigation effects, while acidity has increased. A humus load layer of 18-20 cm thick has formed and fruit trees, vegetables, and valuable grasses now grow on originally poor soils. (Danovich-Wisconsin)
W80-01986

5F. Water Treatment and Quality Alteration

LOW ENERGY MECHANICAL DESTRATIFICATION AND REAERATION OF RESERVOIRS,
Oklahoma Water Resources Research Inst., Stillwater.
For primary bibliographic entry see Field 2H.
W80-01601

SIMULATION AND PROCESS DESIGN OF DEEP BED FILTRATION,
Syracuse Univ., NY. Dept. of Chemical Engineering and Materials Science.
For primary bibliographic entry see Field 5D.
W80-01661

CHLORINATION SYSTEM ANALYSIS,
College of Engineering, Suraboya (Indonesia).
For primary bibliographic entry see Field 6A.
W80-01662

COMBINED TREATMENT WITH OZONE AND ACTIVATED CARBON,
Degremont S. A., Rueil-Malmaison (France).
For primary bibliographic entry see Field 5D.
W80-01663

DISINFECTION BY ULTRAVIOLET LIGHT,
Geo-Environ Ltd., Toronto (Ontario).
B. R. Whitehead.
Canadian Water Well, Vol 5, No 3, p 26-27, August, 1979. 2 Fig, 3 Ref.

Descriptors: *Disinfection, *Ultraviolet radiation, *Water treatment, Cost comparisons, Standards, Chlorination.

Ultraviolet (UV) light in wavelengths between 2000 and 2100 A has a lethal effect on microorganisms. The effectiveness of UV light depends on the radiation intensity, exposure time per unit area, and the chemical and physical characteristics of the water under treatment. Turbidity, color, organic substances and iron can reduce UV exposure and should be removed. Dirt on the lamp and excessive flow rates reduce UV exposure and should be corrected. The minimum exposure of UV for disinfection varies with pH, stage of the organism and with various species. A domestic UV unit manufactured by Trojan Environmental Products, Inc. of London has adequate sagfeguards for an effective disinfection. The advantages and disadvantages of UV treatment as opposed to conventional chlorination are listed. In general, UV treatment is more expensive and less effective than chlorination. (Purdin-NWWA)
W80-01722

WATER SYSTEMS BASICS,
Ground Water Age, Vol 14, No 1, p 69-74, September, 1979. 2 Fig.

Descriptors: *Water treatment, *Water analysis, *Water softening, Gases, Salts, Suspended solids, Microorganisms, Hardness(Water), Domestic water.

Water conditioning is an important part of all water systems and a profitable source of business for water systems contractors. Four basic types of impurities commonly treated are: dissolved gases, dissolved minerals, suspended matter, and microorganisms. The first step in treatment is water analysis. Guidelines for sampling and analysis of municipal water and individual well water supplies are presented. Hardness is a common problem which affects laundering, general housekeeping, cooking and drinking, and heating and plumbing. A water softener exchanges sodium ions for calcium and magnesium ions in the water until all the sodium is used up. The softener then automatically regenerates itself by backwashing with sodium chloride. (Purdin-NWWA)
W80-01735

SUCCESSION OF PHYTO- AND ZOOPLANKTON IN A WASTEWATER STORAGE RESERVOIR,
Mekorot Water Co., Tel Aviv (Israel).
For primary bibliographic entry see Field 5C.
W80-01758

GRADATION OF GRANULAR MEDIA BY VOLUME,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W80-01858

REMOVAL OF SILICA FROM MIXED BED DEMINERALIZER,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
R. A. Blind, R. T. Saterbak, and E. I. Wolfe.
U.S. Patent No 4,163,717, 8 p, 2 Fig, 2 Tab, 5 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 147, August 7, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, *Demineralization, Separation techniques, Anion exchange, Cation exchange, Silica, Resins, *Regeneration, Mixed bed demineralizer.

It has been discovered that when the anion and cation exchange resins of a mixed bed demineralizer are regenerated according to the technique described, substantially complete removal of silica from water can be obtained. This result is premised on the discovery that silica is removed by the cation exchange resin as well as by the anion exchange resin. In order to obtain ultralow levels of silica in water, it has been found necessary to modify the prior procedures for regenerating mixed bed ion exchange resins and pass initially only from about 30 to about 80 volume % of the anion regenerant solution through the anion exchange resin. This effects a partial regeneration of the anion exchange resin by removing the silica and other mineral salts while avoiding contamination of the cation exchange resin. The remaining portion of the anion regenerant solution is then passed through both the anion and cation exchange resins. The subsequent treating of both the anion and cation exchange resins serves to complete the regeneration of the anion exchange resin as well as to remove the silica from the cation exchange resin. (Sinha-OEIS)
W80-01936

TRICKLE IRRIGATION WATER QUALITY AND PREVENTIVE MAINTENANCE,
Science and Education Administration, Phoenix, AZ. Water Conservation, Lab.
D. A. Bucks, F. S. Nakayama, and R. G. Gilbert.
Agricultural Water Management, Vol 2, No 2, p 149-162, June 1979. 3 Fig, 6 Tab, 11 Ref.

Descriptors: *Irrigation operation maintenance, *Emitters, *Irrigation practices, *Application equipment, *Trickle irrigation, *Water quality, Irrigation systems, Maintenance, Water distribution(Applied), Water supply, Irrigation design, Irrigation efficiency, Filtration, Inspection, Pipelines, Distribution systems.

With trickle irrigation systems, emitter clogging is a serious problem that can adversely affect both the rate of water application and uniformity of water distribution, increase operating costs, and destroy the grower's confidence in the system. Here the authors set forth guidelines and recommendations for preventive maintenance of trickle systems, including proper filtration, field inspection, and, under some conditions, chemical treatment and pipeline flushing, with emphasis on improving the quality of water before it reaches the emitters. Based on recognition of the prime importance of water quality in the design and operation of this maintenance program, a tentative water classification system is developed to establish criteria for evaluating the clogging potential of a trickle irrigation water supply. (Tickes-Arizona)
W80-01955

5G. Water Quality Control

A RATIONAL WATER QUALITY CONTROL POLICY,
Birmingham Univ. (England). Dept. of Civil Engineering.
T. H. Y. Tebbutt.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Intitute of Technology, Bangkok, Thailand (Pergamon Press, Inc. in USA), p 31-36, 1978. 3 fig.

Descriptors: *Water quality control, *Water policy, *Rational approach, *Waste water treatment, Effluents, Standards, Effects, Flow, Bio-

chemical oxygen demand, Costs, Benefits, Decision making, Planning, Least-cost solution.

The emergence of environmental lobbies in various countries has resulted in demands for more stringent water pollution control policies. There are growing trends to require the use of the best available technology for wastewater treatment without full justification for the requirement other than in emotive terms. In almost all situations, the removal of contaminants from wastewater becomes increasingly more difficult as the allowable levels in effluents are reduced. Before adopting such high standards it should be shown that the requirements have a sound economic basis and that the benefits to the community by the same expenditure in other areas of health and welfare would not be greater. (Bell-Graf--Cornell)
W80-01611

WATER QUALITY MANAGEMENT,
Urban Development and Public Health Department Mantralaya, Bombay (India).
S. T. Khare.
In: Water pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc. in USA), p 37-41, 1978.

Descriptors: *Water quality control, *Management, *Developing countries, *Maharashtra State(India), Environmental protection, Water utilization, Irrigation, Domestic requirements, Industrial requirements, Objectives, Programs, National strategy, Data needs, Standards, Streams.

There has been an increasing awareness for environmental protection activities in developing countries, and many States are launching ambitious programs in this field. India is one such country where work has begun on pollution control. An Act for the prevention of water pollution was passed by Maharashtra State in 1969, followed by the Government of India in 1974, and now almost all States have adopted the same. In implementing the Act, many problems have to be faced. Water quality management forms an important field in water pollution control. The various aspects of water quality management are discussed herein. (Bell-Graf--Cornell)
W80-01612

PLANNING AND IMPLEMENTING THE TAIPEI SEWERAGE SYSTEM,
Taiwan Provincial Government, Taipei. Sewerage Engineering Dept.
W. K. Liu, and C. F. Ouyang.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani & N. C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 399-405, 1978. 1 Fig.

Descriptors: *Sewage systems, *Sewerage, *Long-term planning, *Environmental control, *Water pollution, *Taipei(Taiwan), Industrial wastes, Municipal wastes, Urban development, Construction, Programs, Projects, Waste collection, Treatment facilities, Dissolved oxygen, Biochemical oxygen demand.

Taipei, located on the northern part of Taiwan, comprises Taipei City and other densely-populated satellite towns. As domestic sewage and industrial waste from the area cannot be promptly discharged into the ocean because of the tidal flow, river pollution and environmental sanitation problems have become increasingly serious. In solving the domestic and industrial wasewater problem, the Taipei City government (in implementing the Master Plan Report of Sewerage Planning in the Greater Area and following the direction of actual urban development) has prepared and carried out a six-year construction program to improve the environmental sanitation situation. (Bell-Graf--Cornell)
W80-01646

MONITORING LANDFILLS,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5A.
W80-01731

PETROLEUM CONTAMINATION OF WELLS,
New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 5B.
W80-01737

ATTEMPTS TO REDUCE EUTROPHICATION IN AN ARTIFICIAL BATHING LAKE,
Technische Hochschule, Graz (Austria).
For primary bibliographic entry see Field 5C.
W80-01752

MOBILIZATION OF METALS FROM SEDIMENT BY NTA,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5C.
W80-01762

INITIAL IMPACTS OF EXPERIMENTAL FISH INTRODUCTIONS ON THE MACROZOOPLANKTON OF SMALL OLIGOTROPHIC LAKES,
British Columbia Univ., Vancouver. Faculty of Forestry.
T. G. Northcote, C. J. Walters, and J. M. B. Hume.
In: Proceedings: Congress in Denmark 1977, Part 3, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 2003-2012, 4 Fig, 13 Ref.

Descriptors: *British Columbia, Canada, *Zooplankton, *Population, *Fish establishment, *Daphnia, *Invasion, *Environmetnal effects, *Fisheries, Crustaceans, Lakes, Fish, Biomass, Growth stages, Fish stocking, Competition, Fish diets, Fish food organisms, Predation, Diptera, Oligotrophy.

Cutthroat trout (Salmo clarki) introduced into Lake Eunice and Dolly Varden (Salvelinus malma) introduced into Lake Katherine, two small oligotrophic lakes in British Columbia, Canada, in 1974-1976, had caused major predation changes but had relatively little effect on crustacean species composition and seasonal abundance. Cutthroat trout and Dolly Varden size increased greatly in formerly fishless lakes compared to donor lakes; some more than tripled their weight by the first summer. However, third and fourth instars of two Chaoborus larval species, C. americanus and C. Trivattatus, were drastically reduced. Some individual fish stomachs contained nearly 1000 fourth instar larvae. Crustacean macrozooplankton total numbers were surprisingly similar between the control and two previously fishless lakes, before, during and after fish introduction. Of 10 crustacean macrozooplankton species, only two, Daphnia rosea and Diaptomus kenai, decreased considerably in 1975 and 1976 lakes with fish introduced. Bosmina longirostris varies in response; Lake Eunice numbers were lower in years following fish introduction. D. kenai bodysize decreased sharply in 1975 and 1976 compared with 1974. In contrast, average Bosmina size is significantly larger in fish introduced lakes in 1975-1976 than in previous years. However, fish predation might not directly cause body size changes. Chaoborus removal by fish may result in decreased juvenile D. kenai mortality and thus higher abundance and lower individual growth rates and adult body sizes. (Danovich-Wisconsin)
W80-01767

APPLICATION OF STREAM ECOLOGY TO RAISING SALMON SMOLTS IN HIGH DENSITY,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
J. H. Mundi, and D. E. Mounce.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 2013-2018, 1 Fig, 3 Tab.

Descriptors: *Salmon, *Smolt, *Big Qualicum River(Canada), *Growth rates, *Fish farming, *Fish diets, Salmonids, Marine fish, Commercial fish, Vancouver(Canada), British Columbia, Fish food organisms, Fish management, Fish hatcheries, Rivers, Nutrients, Nutrient requirements, Invertebrates, Food habitats, Growth stages, Fry, Mortality, Fish populations, Fisheries, *Canada.

Fundamental stream characteristics can be useful as strategies for rearing coho salmon (oncorhynchus kisutch) in high density during their freshwater stage. A channel excavated alongside Big Qualicum River, Vancouver Island, British Columbia, employed a riffle/pool sequence at a meander for rearing coho smolts. The fast-flowing riffle produces zoobenthos food and transports invertebrate drift; the pool provides habitat where fish eat incoming drift; and the undercut bank provides cover or shade. Big Qualicum experimental rearing channel is 396.2 m long and 4.57 m wide; riffle depth is 15 cm and pool depth is 0.9 m. Commercial moist mash and pellets were offered to small fry at 75% hatchery rations. Fry samples in June and September during the first year show 65% with natural food at upstream channel areas and 91% at downstreams areas. Downstream has lower fry density and greater invertebrate enrichment. Most common invertebrates in the pools and riffles are Orthocladiinae, Tanytarsini, Chironomini, and Oligochaeta. Riffle food production buffers any inconsistencies in commercial diets, reduces costs, and lets fish acquire natural feeding modes by pursuing moving prey, thus assisting adaptation to estuarine life. In the following February, fry were clipped and tagged. Mortalities amounted to 37% since stocking; 15% were due to dead or weak fish removed from screens, the remaining losses were attributed to predation by mammals such as mink, and birds such as the great blue heron, common merganser, and belted kingfisher. (Danovich-Wisconsin)
W80-01768

ON THE REOXYGENATION EFFICIENCY OF DIFFUSED AIR AERATION,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Hydromechanik.
M. Markofsky.
Progress in Water Technology, Vol 11, No 3, p 59-71, 1979. 10 Fig, 4 Tab, 9 Ref.

Descriptors: *Oxygenation, *Dissolved oxygen, *Aeration, *Diffusion, Oxygen, Air, Mixing, Laboratory tests, Bubbles, Water pollution, Water quality, Water quality control, Reaeration, Water treatment, Bubble curtains.

One technique used to increase the dissolved oxygen concentration of polluted waters is the bubbling of air through a diffuser pipe located at depth, thereby producing a bubble curtain from which oxygen transfer to the water occurs. The results of laboratory studies on the aeration efficiency of a diffuser placed along the entire width of a flume, perpendicular to a cross flow, were presented (two dimensional aeration). Parameters investigated included (1) diffuser type--porous materials with mean pore sizes of 40 micrometers, 90 micrometers and 180 micrometers and perforated pipes with 0.4, 0.6, and 1.0 mm diameter ports, (2) air flow rate per unit width (3-53 cu m/mxh), and (3) cross flow velocity (2.5-15 cm/s). The effect of variation from the two dimensional situation was also discussed as well as the consequence of using oxygen instead of air, the sensitivity to discharge angle, port spacing, and the free surface. The measured efficiencies were compared with theory as well as available laboratory and field data. The major conclusions were (1) Aeration efficiencies using diffused air aeration are on the order of 2-13%/m. (2) The aeration efficiency increases with increasing cross flow velocity and decreasing air flow rate per unit width. (3) Aeration efficiencies using porous filters, for air flow rates less than 40 cu m/mxh, are significantly higher (a factor of 2-3) than those achieved using perforated pipes. (4) Changing the pore size from 40 micrometers to 180 micrometers, the port size from 0.4 to 1.0 mm, or the port spacing does not significantly affect the

aeration efficiency. (5) Aeration using oxygen is somewhat less efficient than that using air. However, since equivalent oxygen bubbles contain approximately 5 times more oxygen than air bubbles, more oxygen is transferred on an absolute basis at the same gas flow rate using compressed oxygen as opposed to air. (6) Aeration efficiency resulting from aeration over a portion of the entire width can be reasonably predicted using the results of the two dimensional studies. (7) The available laboratory and field data compare well with results of these laboratory studies. (Sims-ISWS)
W80-01846

RUNOFF CONTROL COMPARISONS FOR COMMERCIAL BEEF CATTLE FEEDLOTS,
Science and Education Administration, Lincoln, NE.
C. B. Gilbertson, J. A. Nienaber, J. L. Gartung, J. R. Ellis, and W. E. Splinter.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 842-846, 849, July-August 1979. 1 Fig, 6 Tab, 21 Ref. EPA S802197.

Descriptors: *Feed lots, *Runoff, *Water quality control, *Farm wastes, *Nebraska, Control systems, Ponds, Settling basins, Sewage treatment, Soil disposal fields, Waste disposal, Waste water disposal, Livestock, Agriculture.

A runoff control system was installed under EPA sponsorship on the L.P. Schram Feedlot, Papillion, Nebraska, to determine runoff characteristics from a large feedlot, and the adequacy of current runoff control system design criteria. System components were sediment basins, conveyance channels, holding ponds, and a disposal system. The quantity of runoff during this study was 73% of that reported for small feedlots. However, about 30% below normal annual precipitation and relatively light snowmelt explain this discrepancy. The total solids content of the holding pond was 25% below that of published values. All values for total and volatile solids, electric conductivity, pH, nitrogen, phosphorus, and COD were within published ranges. Recommendations were made for the design of feedlot runoff control systems. (Sims-ISWS)
W80-01851

SIZING COMPONENTS ON OPEN FEEDLOT RUNOFF-CONTROL SYSTEMS,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
J. A. Anschutz, J. K. Koelliker, J. J. Zovne, T. A. Bean, and M. J. Peterson.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 803-808, July-August 1979. 3 Fig, 8 Tab, 15 Ref.

Descriptors: *Feed lots, *Runoff, *Water pollution control, *Model studies, Mathematical models, Farm wastes, Livestock, Climatology, Evaporation, Precipitation(Atmospheric), Rainfall, Moisture deficit, Ponds, Storage, Agriculture, Feed lot runoff.

A computer-simulation model for open feedlot runoff control systems was used to develop a data base of important climatic variables that can affect the performance of systems. Moisture deficit was found to be most important for irrigation-disposal systems; the ratio of precipitation to evaporation was most important for evaporation systems. A method to size components of feedlot runoff control systems for any specific location was presented, along with necessary coefficients for the method. Variables included were location, soils, crops, disposal area, disposal rate, retention pond depth, disposal management, and percent of runoff controlled. (Sims-ISWS)
W80-01855

REMOVAL OF SILICA FROM MIXED BED DEMINERALIZER,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
For primary bibliographic entry see Field 5F.
W80-01936

PHOSPHATE BAN LOWERS REMOVAL COSTS,
Escanaba Wasterwater Treatment Plant, MI.
For primary bibliographic entry see Field 6C.
W80-01971

AUTOMATIC WATER/SEWER SAMPLER,
For primary bibliographic entry see Field 5A.
W80-01992

WATER CONDITIONS IN THE STOCKHOLM ARCHIPELAGO AFTER THE INTRODUCTION OF BIOLOGICAL AND CHEMICAL PURIFICATION OF WASTE WATER,
Stockholm Water and Sewerage Works (Sweden).
For primary bibliographic entry see Field 5C.
W80-01994

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

COMPUTER ALGORITHMS FOR ASSESSING REGIONAL RIVER RECREATION RESOURCES,
OKalhoma State Univ., Stillwater. Dept. of Geography; and Oklahoma Water Resources Research Inst., Stillwater.
R. D. Hecock, S. W. Tweedie, and J. F. Rooney, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116635, price codes: A06 in papercopy, A01 in microfiche. Report, March 1979, 114 p. 8 Fig, 13 Tab, 4 Append. OWRT B-035-OKLA(1), 14-34-0001-7180.

Descriptors: Rivers, *Recreation demand, *REcreation facilities, Computer models, Computer programs, Regional analysis, Central U.S., Bibliographies, Reviews, *River recreation resources.

The research addressees the following objectives: modification of existing computer program, testing of the program in Oklahoma, and evaluation of the capabilities of the system. The following procedures were undertaken: RECSAD II was developed; parameters of river use were obtained; simulations were performed under different assumptions of river use levels; river use data were compared with simulated values; the project was assessed. Accurate prediction of recreation travel for rivers was not obtained. Insights into the problems of modeling river recreation travel are discussed. Programs for assessing and describing travel patterns are presented.
W80-01602

PREVENTIVE CONTROL OF WATER POLLUTION IN DEVELOPING COUNTRIES,
Ahmadu-Bello Univ., Zaria (Nigeria). Dept. of Civil Engineering.
B. Z. Diamant.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, Feb. 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh, Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 9-15, 1978. 1 Ref.

Descriptors: *Water pollution control, *Prevention, *Developing countries, Management, Decision making, Legislation, Industrialization, Pollution sources, Training.

The different factors affecting water pollution control in developing countries are briefly reviewed. The differences in management decision making processes in developed and developing countries are compared and implications are discussed. Covered herein are pollution sources, industrialization, legislation, and training. It is apparent that a distinct approach must be promulgated for developing countries. (Bell-Graf--Cornell)
W80-01609

INTEGRATED POLLUTION CONTROL -- A MODEL FOR DEVELOPING COUNTRIES,
Shri Govindram Seksaria Technological Inst., Indore (India).
M. V. Ranganath, and T. A. Sihorwala.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc., in USA), p 85-91, 1978. 8 Tab, 3 Ref.

Descriptors: *Pollution abatement, *Mathematical models, *Developing countries, *India, Water policy, Planning, Industries, Air pollution, Water pollution, Sewage, Effluents, Costs, Treatment, Damage index, Data analysis, Systems analysis.

The Government of India passed the Water Pollution Act in 1974. This paper analyzes a macro model of water pollution control in Madhya Pradesh State in India. The analysis shows that developing countries should adopt short-term and long-term policies. In Madhya Pradesh, pollution in selected industries reduces the water pollution by more than 80%. Similar results are true for air pollution as well. Proper composting of garbage reduces air pollution and indirect water pollution and also produces much needed fertilizer. As a long-term policy, it may be necessary to introduce the Sewerage System and permit industries to connect their effluents after preliminary treatment. (Bell-Graf--Cornell)
W80-01616

A SYSTEMS APPROACH TO WATER QUALITY CONTROL: SG. S. KIRI, MALAYSIA AS A CASE STUDY,
Singapore Univ. Dept. of Civil Engineering.
K. K. Chin.
In: Water pollution Control in Developing Countries. Proceedings of the International Conference hlad at Bangkok, Thailand, February 1987. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology Bangkok, Thailand (Pergamon Press Inc. in USA), p 103-110, 1978. 4 Fig, 3 Tab, 5 Equ, 4 Ref.

Descriptors: *Water quality control, *Systems analysis, *Optimization, *Flow *Cost minimization, *Sungeli S. Kiri river(Malaysia), *Simulation analysis, Industrial wastes, Measurement, Mathematical models, Equations, Dissolved oxygen, Biochemical oxygen demand, Constraints, Water treatment, River basins, Environmental control, Generalized Reduced Gradient method.

The Sungei (river) S. Kiri in Malaysia has experienced pollution problems as a result of industrial discharges and peat field runoff. The organic substances from palm oil waste discharge completely depleted the dissolved oxygen in the upstream section during low flow conditions. The oxidation of sulfide runoff from peat fields not only depleted the DO but also lowered the pH of the water and increased its iron and sulfate contents. To clean up the river, waste discharge and surface runoff would have to be controlled. This paper outlines the problem and proposes a systems approach for its solution. The Generalized Reduced Gradient method is used to derive optimal flows and annual least-cost abatement. The systems approach to management of the river basin must involve complete analysis of water quality models and environmental control procedures, taking into consideration various water use patterns, water quality criteria, and waste inputs. (Bell-Graf-Cornell)
W80-01618

CHLORINATION SYSTEM ANALYSIS,
College of Engineering, Suraboya (Indonesia).
P. M. Berthouex.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 597-606, 1978. 6 Fig, 2 Tab, 12 Equ, 12 Ref.

Descriptors: *Chlorination, *Water treatment, *Systems analysis, *Optimization, *Cost minimization, Estimating, Kinectics, Design, Mathematical models, Equations, Sensitivity, Inflation, Developing countries.

A minimal cost pollution control system or process must be well designed and properly operated. This paper considers the design of a process that requires addition of an expensive material that changes in cost as energy supplies and costs change. The objective is to show how construction costs can be traded against operating costs, how increases in process loading can be handled in the analysis, and how inflation of the operating costs influence decision making. The example used is chlorination system design, as it involves many design concepts and yet is simple enough that the modeling does not obscure decision making. (Bell-Graf--Cornell)
W80-01662

WATER SUPPLY PLANNING MODEL FOR WEST AFRICA,
Thayer School of Engineering, Hanover, NH.
P. H. Kirshen.
Journal of the Water Resources Planning and Management Division, Proceedings of the American society of Civil Engineers, Vol 105, No WR2, p 413-427, September 1979. 2 Fig, 3 Tab, 17 Equ, 8 Ref.

Descriptors: *Water resources, *Optimization, *Planning, *Africa, *Arid lands, Water supply, Mathematical models, Systems analysis, Mixed-integer programming, Regional analysis, Benefit maximization, Cost minimization, Water demand, Decision making, Constraints, Equations, Hydrology, Groundwater, Surface waters, Annual, Seasonal.

A mixed integer programming (MIP) optimization model is formulated for use in the arid, underdeveloped Sahel-Sudan region of West Africa. Its purpose is to determine either the least-cost set of sources to meet fixed demands or the sources and water uses that maximize the net benefits of water use. Since for planning purposes the model is designed to apply to the entire region and some subareas have only small-scale development options, both large and small scale development of a wide variety of demands and supplies are modeled. The function can be expressed either as the minimization of supply costs or as the maximization of the net benefits of water use. The major constraints are that in each planning subarea and in each season hydrologic continuity must exist, and demand must be met. The major devision variables are the capacities of supply sources, and in the net benefit maximization case the water demand quantities. MIP is used to model the possibility of different reservoir operating at a site. (Bell-Graf--Cornell)
W80-01678

EVALUATION OF ALTENATIVE STORM-WATER DETENTION POLICIES,
Pirnie (Malcolm) Inc., White Plains, NY.
G. E. Kamedulski, and R. H. Mc Cuen.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR2, p 171-186, September 1979. 1 Fig, 8 Tab, 20 Equ, 6 Ref.

Descriptors: *Water policy, *Alternative planning, *Storm water, *Detention basins, *Simulation analysis, *Model studies, *Runoff, *Sediments, Evaluation, Optimization, Design, Equations, Watersheds(Basins), Drainage, Erosion, Flood control, Flood frequency, Hydrology, Water management(Applied), Reservoirs, Systems analysis.

Mathematical modeling has been found to be a quick, inexpensive and effective means of evaluating existing stormwater detention policies and examining alternative policies. A stormwater model was calibrated with data collected from a watershed located in Montgomery County, MD. The data base included measured precipitation and both sediment and flow into and from the detention basin. Model studies have indicated that many existing SWM policies do not meet the intent of SWM because they ignore the volume-duratin frequency concept tha has long been used in hydrologic design. SEM policies often fail to specify a duration for detention basin design and limit the design frequency to a single return period. A detention basin that is designed using a policy based on a single return period will not limit the entire flood frequency curve to that of the before-development conditions, and thus the policies do not satisfy the intent of a SWM. Also, less costly designs are possible if both basin volume and outlet characteristics are considered simultaneously. (Bell-Graf--Cornell)
W80-01689

INTEGRATED DEVELOPMENT OF RIVER BASINS OVERVIEW AND PERSPECTIVES,
National Water Authority, Budapest (Hungary).
I. Degen.
In: River Basin Development: Policies and Planning. Volume 1. Proceedings of the United Nations Interregional Seminar on 'River Basin and Interbasin Development,' Budapest, Hungary, September 1979. In cooperation with the UN development Programme and the National Water Authority of Hungary. p 3-19, 1976. 2 Fig, 2 Map, 68 Ref.

Descriptors: *River basin development, *Planning, *Water resources, *Water policy, Economics, Environment, Social aspects, Management, Evaluation, Systems analysis, Decision making, Optimum development plans, Analytical techniques, Objectives, Achievement, Integrated approach.

In modern times, all aspects of the multilateral relationship between socio-economic development and the natural environment are closely related to water conditions. Therefore, river basin development designed to manage water resources on a basin-wide scale has become one of the decisive factors in the evolutions of socio-economic advancement. Former isolated projects of local significance have been replaced by technically, economically superior water systems developed gradually and operated in coordination. In order to determine the proper development option in which limited economic and natural resources can be developed to the greatest benefit, the integrated approach to river basin development is called upon, which is realized substantially by attempting to include the largest possible number of effects into the sphere of decisions related to the development objectives. The exact identification and evaluation of development objectives and effects are fundamental prerequisites. Multiobjective decision theory should be applied along with systems analysis in order to evaluate achievement; special emphasis should be placed on the social and environmental aspects of river basin development, followed by an ex-post evaluation of river basin projects and the interbasin transfer of water resources. The application of advanced decision analysis methods does not exempt the decision maker and planner from making individual or collective judgement nor from checking conclusions against experience. (Bell-Graf--Cornell)
W80-01693

RIVER BASIN DEVELOPMENT FOR SOCIO-ECONOMIC GROWTH GENERAL REPORT,
National Water Authority, Budapest (Hungary).
L. David.
In: River Basin Development: Policies and Planning. Vol 1. Proceedings of the United National Interregional Seminar on 'River Basin and Interbasin Development,' Budapest, Hungary, September 1979. In cooperation with the UN Development Programme and the National Water Authority of Hungary. p 25-37, 1976. 2 Fig, 7 Equ, 41 Ref.

Descriptors: *River basin development, *Socio-economic growth, *Comprehensive planning, *Systems analysis, *Water resources, Estimating, Equations, Optimum development plans, Long-term planning.

The objective of this general report is to analyze the inseparable link between socio-economic growth and river basin development considering the latter to be a subsystem of the former. To achieve this objective, the concept of comprehensive river basin development is discussed, its systems analysis is presented, and on this basis, some of the main conditions and means of reasonable implementation of river basin development are determined. The paper lists conclusions and proposals to be used as a basis for the findings and recommendations of the seminar. The purpose of river basin development is to achieve the optimum use of natural water resources on a basin-wide scale during socio-economic growth. Comprehensive river basin development which has three evolutionary periods, must be a planned complex and interdisciplinary process controlled on a systems analysis basin. The main components of river basin development systems can be divided into four groups: components of socio-economic development; socio-economic needs for river basin development; resources needed for river basin development; and engineering activities. The system can be built up on the basis of these components and their relations. (Bell-Graf--Cornell)
W80-01694

AGRICULTURAL ENERGY MODELING: DISCUSSION OF LINEAR PROGRAMMING MODELS,
Minnesota Univ., Minneapolis; and Minnesota Univ., St. Paul.
V. R. Eidman.
American Journal of Agricultural Economics, Vol 60, No 2, p 1081-1082, May 1978. 3 Ref.

Descriptors: *Agriculure, *Energy, *Model studies, Simulation analysis, Linear programming, Optimization, Alternative planning, Regional analysis, Economic impact, Water resources, Land resources, Systems analysis.

This short article discusses problems in the aggregate use of simulation and inter-regional programming optimization models that simultaneously select production systems for alternative regions. There is a need for detailed analyses of crop enterprise production systems at the firm level. The models should consider embodied energy when evaluating alternative technologies. Finally, an area needing study is the evaluation of changes in institutional arrangements to encourage energy efficiency. (Janet Bell-Graf)
W80-01698

UTILIZATION OF DISSOLVED ORGANIC CARBON BY HETEROTROPHIC BACTERIA AND PROTOZOA,
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
For primary bibliographic entry see Field 6G.
W80-01797

COMPUTER MODELING FOR THE LAKE TAHOE BASIN: IMPACTS OF EXTREME LAND-USE POLICIES ON KEY ENVIRONMENTAL VARIABLES,
California Univ., Davis.
B. A. Sloane, and T. E. Dickinson.
Journal of Environmental Systems, Vol 9, No 1, p 39-56, 1979. 1 Fig, 6 Tab, 15 Ref.

Descriptors: *Lake Tahoe(CA/NV), *Computer models, *Land use, *Alternative planning, *Regional economics, California, Nevada, Model studies, Population, Tourism, Employment, Water quality, Environmental effects, Planning, Public participation, Zoning, Social aspects, Industrialization, Housing, Economic impact, Construction.

A socio-economic computer simulation model of population, growth and land-use in the Lake Tahoe Basin utilizes the best available statistical data and incorporates views of regional planners and interested citizens. The model compares broad long-range social and economic implications of potential governmental policies. Major variables or submodels are: available jobs; locally employed seasonal residents; housing demand; housing supply; housing market reconciliation; basin acreage; year-round residents employment status; business units; year round residents' age structure;

tourist visitor days; tourist amenities; and special factors. Computer simulation runs were made of seven extreme land-use policy packages which included the following policies: (1) construction and subdivision moratorium; (2) housing occupancy limitation, (3) removal of most campground and commercial limitations; (4) increase in number of residential units per acre; (5) additional acres zoned residential; (6) doubling of gambling casino facilities; and (7) new light industry. Each policy package was simulated using three different model versions to accomodate its high sensitivity to assumptions about tourism. Results show that the number of acres developed and the related lake water clarity reduction would be greater with upzoning policies such as density variances than with simulatory ones such as new industry promotion. (Luedtke-Wisconsin)
W80-01963

ECOLOGY AND ECONOMICS IN LAGOS STATE,
Ibadan Univ. (Nigeria). Dept. of Geography.
O. Areola, and A. Faniran.
The Nigerian Journal of Economic and Social Studies, Vol 17, No 1, p 63-76, March 1975. 1 Fig, 11 Ref.

Descriptors: *Land resources, *Lagos State, Nigeria, *Land use, *State jurisdiction, *Land management, *Adoption of practices, Nigeria, Africa, Land classification, Land development, Regional economics, Governments, Jurisdiction, Regulation, Land ownership, Data collections, Social aspects, Plainning, River basin development..

Rational uses of land resources for economic development within constraints of environmental conservation requirements and government planning efforts are discussed for Lagos State, Nigeria. Ths state is small, with vast stretches of swamp and river floodplain; but population density has greatly increased due to in-migration around metropolitan Lagos, the national capital. Land therefore is scarce and careful planning is needed to balance private land use rights with conservation needs. However, there are few codified laws relating to land resources and owners have exclusivity of rights even over streams running through their properties. As an initial step, the state government might assume rights of control over sparcely settled lands such as coastal barrier ridges, flat sandy plains, swamps and river floodplains. In densely settled areas, government land use controls could be exercised through such means as selective siting of industrial estates and planned growth for urban service centers. However, no effective planning can be started without first completing a comprehensive survey of all land resources in the state. Three options are given to improve data collection for such a survey: (1) create a Federal coordinating body for data collection, analysis, and storage, possibly in the Ministry of Economic Developmet; (2) create an independent data collection body on an inter-agency basis; (3) create separate data banks for each state government. (Harris-Wisconsin)
W80-01966

CURRENT USE OF WATER SURFACE ZONING FOR RECREATION,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Natural Resources.
T. L. Brown, E. J. Finegan, and M. P. Voiland.
Water Resources Bulletin, Vol 15, No 2, p 337-344, April 1979. 6 Ref.

Descriptors: *Recreation demand, *Water zoning, *Competing uses, *Regulation, *State governments, *Local governments, Zoning, Recreation, Non-structural alternatives, Boating, Swimming, Fishing, Water skiing, Water quality control, Planning.

Water surface zoning methods are increasingly used to provide safe, equitable recreation opportunities as well as a water quality protection among competing uses. Zoning techniques employed by state and local governments in 1976-1977 can be organized into five broad categories: (1) restrictions on boat speed and horsepower; (2) special use zoning which limits or prohibits specific activities; (3) time zoning, which confines activities to certain times of the day or between certain dates; (4) protective space zoning, which separates incompatible activities; and (5) limited density zoning which restricts the number of recreation participants. States which frequently use water surface zoning find it effective regardless of types or means of implementation. However, for successful utilization, a number of conditions must be met: (1) In cases where the shore is not entirely under state jurisdiction, local input and concurrence are required. (2) Regulations must be consistent with other state laws. (3) Regulations must be well publicized and posted. (4) Regulations must be enforceable. Zoning techniques have been used on inland waters of limited size which have high multi-use recreation demand. (Luedtke-Wisconsin)
W80-01973

6B. Evaluation Process

COMPUTER ALGORITHMS FOR ASSESSING REGIONAL RIVER RECREATION RESOURCES,
OKalhoma State Univ., Stillwater. Dept. of Geography; and Oklahoma Water Resources Research Inst., Stillwater.
For primary bibliographic entry see Field 6A.
W80-01602

ARTIFICIAL WETLANDS: VALUES, REGULATORY, AND DEVELOPMENTAL ISSUES,
Rhode Island School of Design, Providence. Div. of Architectural Studies.
J. E. Lukens, and J. M. Everett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-115934, Price codes: A02 in papercopy, A01 in microfiche. Rhode Island Water Resources Center, University of Rhode Island, Kingston, Project Completion Report 1978. 12 p. OWRT A-066-RI(1), 14-34-0001-7084.

Descriptors: *New England, *Evaluation, *Artificial wetlands, Natural wetlands, Value, Recreation, Water supply, Flood control, Sediment control.

Artificial wetlands were compared to natural wetlands in four towns in southern New England to determine their relative scenic, open space, and recreation values (the latter being primarily a function of wildlife habitat). The results showed that unmanaged artificial wetlands assume values within a few years that are virtually undistinguishable from the values of natural wetlands. The historical effects of wetlands upon settlement patterns were examined, with the conclusion that for the most part they have acted to contain and guide growth in a beneficial manner, and this can be expected to continue in the future under state wetland acts. However some situations may be expected to occur whereby the wetland filling would be desirable, provided the values lost can be recreated in artificial situations. It is suggested that the wetlands acts be modified to encourage both this procedure and the necessarily concomitant process of assessing relative wetland values.
W80-01603

WATER POLLUTION CONTROL--SOME LATIN AMERICAN APPROACHES,
Pan American Health Organization, Lima (Peru).
W. A. Castagnino.
In: Water pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 17-28, 1978. 6 Fig, 4 Ref.

Descriptors: *Water pollution control, *Water quality, *Latin Ameria, *Developing countries, *Methodology, Constraints, Mathematical models, Standards, Costs, Discount rates, South American, Investment, Pollutants, Alternative planning, Decision making, Optimal solution, Treatment, Pollution loads, Water body response, Objectives.

Reviewed is the evolution of water quality studies and control actions in Latin American countries where the setting of objectives and constratints plus the water body response to the loads are shown to be essential prerequisities. Therefore, a water quality model must be structured with pertinent parameters to find the most appropriate remedial action. Case studies of the Cauca River and Guanabara Bay in South American are presented herein. The inconvenience of adopting 'a priori' standards for developing countries is stressed by showing the incidence in costs caused by high discount rates for initial investments among other aspects. Finally, the paper analyzes the problems to overcome for proper water pollution studies in Latin America. (Bell-Graf--Cornell)
W80-01610

SOME ASPECTS OF WATER POLLUTION CONTROL IN SRI LANKA,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
A. Amirtharajah.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh, Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc., in USA), p 77-82, 1978. 2 Fig, 2 Tab, 1 Equ, 5 Ref.

Descriptors: *Water pollution control, *Programs, *Kelani Ganga River(Sri Lanka), Environmental preservation, Economic growth, Hydrology, Rivers, Industrial development, Water quality, History, Streeter-Pheips equation, Developing countries, Technology, Legislation.

The validity of some general principals for an effective water pollution control program in developing countries is illustrated with a case study of the Kelani Ganga in Sri Lanka. By applying some of these principles, economic growth with industrial development can be pragmatically balanced with preservation of the environment. The essential need for legislation, a central authority, and low-cost technology systems is illustrated. (Bell-Graf--Cornell)
W80-01615

IMPLEMENTATION OF WATER POLLUTION CONTROL PROGRAM: A JOINT INDUSTRY-GOVERNMENT APPROACH,
All India Inst. of Hydgiene and Public Health, Calcultta.
K. J. Nath, and A. Dasgupta.
In: Water Pollution Control Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc., in USA) p 93-101, 1978. 2 Fig, 2 Tab, 3 Ref.

Descriptors: *Water pollution control, *Programs, *Developing countries, *Governments, *Industries, *Constraints, *India, Planning, Effluents, Standards, Water resources, Municipal wastes, Industrial wastes, Technical aspects, Financial aspects, Legiglation, Scheduling.

Wate Pollution control on a large scale is gaining momentum in India and in other developing countries. As rapid industrial development has been rather haphazard and uncontrolled, eneven urban and industrial growth has taken place resulting in the discharge of heavy municipal and industrial waste loads on water courses. In India, the Water Pollution Control Act was promulgated in 1974 which established effluent discharge standards and various programs to reduce water pollution have been experimented. However, the progress to data is far from satisfactory. Herein, an attempt has been made to identify the major constratints in evolving a sound water quality management program. The authors also propose a joint industry-government approach for the management of water pollution problems in heavily industrialized urban complexes. The technical and financial aspects of the proposed plan are discused and a definite time table for implementation in a particu-

lar complex in West Bengal state in eastern India is suggested. (Bell-Graf--Cornell)
W80-01617

RIVER, ESTUARY, LAKE AND RESERVOIR QUALITY MANAGEMENT,
Department of Irrigation, Colombo (Sri Lanka).
For primary bibliographic entry see Field 5A.
W80-01624

OPTIMIZATION OF SEWAGE TREATMENT AND FISH PROPAGATION IN PONDS,
Asian Inst. of Tech. Bangkok (Thailand). Div. of Environmental Engineering.
S. Muttamara, and G. Wattayakorn.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 241-251, 1978. 5 Fig, 7 Tab, 8 Ref.

Descriptors: *Optimization, *Sewage, *Treatment, *Fish propagation, *Ponds, *Developing countries, *Economic analysis, Tropical countries, Economic feasibility, Operating costs, Thailand, Oxidation lagoons.

In tropical countries like Thailand, where the climate is sunny and warm, oxidation ponds have become a popular method of treating domestic waste. The main advantage of this process lies in its low cost of construction and simplicity of operation and maintenance. Besides its high efficiency of BOD removal, it has the added advantage of the possible by-product recovery of algae which is rich in protein content. Oxidation pond effluent can also be used for fish cultivation. Undiluted oxidation pond effluent has been found to be too toxic for fish, because the excessive growth of algae results in the depletion of dissolved oxygen causing fish mortality. Diluted algae pond effluent (33 and 50%) was found to be optimum for fish growth. An economic analysis of the oxidation fish pond system indicated that the operating costs of waste treatment could be markedly reduced or even turned into a profit for the community involved. (Bell-Graf--Cornell)
W80-01633

A BCCIPA MODEL FOR WATER RESOURCE PROJECT EVALUATION,
Midwest Research Inst., Kansas City, MO.
B. C. Liu.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 253-259, 1978. 1 Fig, 12 Ref.

Descriptors: *Water resources, *Projects, *Mathematical models, *Cost-benefit analysis, *Economic impact, *Social impact, *Lakes, *Assessment, *Water quality, Water pollution control, Improvement, Decision making, Simulation analysis, Probability, Planning, United States, Systems analysis.

Following the enactment of the Flood Control Act in 1944, a subcommittee on evaluation standards of the Inter-Agency Committee on Water Resources was established in the United States for the purpose of formulating mutually acceptable principles and procedures for determining benefits and costs of water resource projects. In 1973, the Water Resources Council established principles and standards for planning for water and related land resources development, management and utilization. The primary objective of this paper is to develop a Benefit-Cost Cross-Impact Probabilistic Model describing and evaluating some very critical socio-economic impacts related to water resource planning and project management for ultimate improvements in water quality and pollution control in the United States. Discussed is the BCCIPA model for evaluating the effectiveness of lake restoration projects, including direct and indirect impact assessment, as well as induced impact assessment; considered is the model's application and the technical restoration demonstration project. (Bell-Graf--Cornell)
W80-01634

THE IMPORTANCE OF INDUSTRIAL EFFLUENT SURVEYS AND EFFECTS IN THE ECONOMICAL CONTROL OF WATER POLLUTION,
International Consulting and Lab. Services (England).
For primary bibliographic entry see Field 5C.
W80-01637

WATER RESOURCES EDUCATION REQUIREMENTS OF ENGINEERING FIRM,
Harza Engineering Co., Chicago, IL. Water Resources Div.
A. H. Schultz, and R. A. Westmore.
Journal of the Water Resources Planning and Management division, Proceedings of the American society of civil Engineers, Vol 105, No WR2, p 377-384, September 1979.

Descriptors: *Employment, *Consulting engineers, *Engineering education, *Employee relations, *Undergraduate study, Water resources, Water conservation, Land development, Personal attributes, Improvement, Programs.

The overall quality of college-level education in water resources planning and engineering is high, based on the qualifications of recent graduate engineers seeking employment in consulting engineering work. Certain deficiencies in water resouces education background still exist which, if alleviated, would reduce the time spent by consultants for training. The writers, engineers in the Water Resources Division of an international consulting firm specializing in the development of water, land, and power resources, provide a summary of the qualities looked for in hiring recent graduates, highlight specific areas where educational improvement is desirable, and provide suggestions for improving the educational experience to the benefit of both the student and the prospective employer. (Bell-Graf--Cornell)
W80-01680

VOTER REACTION TO MULTIPLE-USE DRAINAGE PROJECTS,
Georgia Inst. of Tech., Atlanta.
T. N. Debo, and J. T. Williams.
Journal of the Water Resources Planning and Management Division, Proceedings, of the American society of Civil Engineers, Vol 105, No WR2, p 295-303, September 1979. 4 Fig, 3 Tab.

Descriptors: *Land use, *Urban development, *Surveys, *Data collections, *Bond issues, *Multiple use, Planning, flood control, Drainage, Urban planning, Public works, Georgia, Projects, Watershed(Basins), Residential areas, Questionnaires.

A survey was conducted to study the reasons why a drainage bond referendum in DeKalb County, Ga. was defeated and the political feasibility of using a multiple-use concept as a replacement. The resuls of the survey confirmed two important points: (1) the more directly people perceive themselves to be affected by a problem, the more likely they are to support a government program to correct that problem; and (2) a significant number of voters will not support a government program they perceive to be poorly planned even though they may support the goals of the program. Both of these points support the concept behind the multiple-use concept, which received much greater support in the survey than the single-purpose concept that was defeated. A summary of survey results is presented to document discussions and conclusions. (Bell-Graf--Cornell)
W80-01683

SALINITY CONTROL PLANNING FRAMEWORK,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
G. V. Skogerboe, W. R. Walker, and R. G. Evans.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR2, p 329-341, September 1979. 5 Fig, 1 Equ, 9 Ref.

Descriptors: *Water plans, *Salinity, *Water management(Applied), *Cost effectiveness, Optimization, Irrigation, Water pollution, Water resources, Planning, Assessment, Agriculture, National goals, Inflow-outflow analysis, Hydro-salinity analysis, Simulation analysis, Mathematical models, Best management practices, Systems analysis.

An accurate assessment of salinity problems in an irrigated area requires detailed knowledge not only of the hydrology, but also of many other unique physical and institutional characteristics of the areas being studied. Even though each area must be evaluated individually, because of the site-specific nature of irrigated agriculture, definite procedures are common to all evaluations. A framework for planning a salinity control program has been developed which can be applied to any individual irrigated valley or to an entire river basin. The salinity control planning framework consists of three phases: (1) identification of salinity problems, utilizing inflow-outflow analysis and hydro-salinity and hydro-salinity analysis; (2) development of best management practices, using soil moisture-chemistry simulation and cost-effectiveness analysis; and (3) implementation of best management practices. The planning steps in each phase are considered herein. (Bell-Graf--Cornell)
W80-01690

OPTIMAL CAPACITY OF MUNICIPAL WATER SUPPLY PUMPS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4A.
W80-01691

TO BUILD OR NOT TO BUILD: A BAYESIAN ANALYSIS,
Arizona Univ., Tucson.
L. Duckstein, R. Krzysztofowicz, and D. Davis.
Journal of Hydrological Sciences, Vol 5, No 1, p 55-68, 1978. 1 Fig, 21 Equ, 10 Ref.

Descriptors: *Bayesian decision analysis, *Hydrology, *Design, *Economics, *Risk, *Uncertainty, *Binomial events, Evaluation, Equations, Probability, MathemAtical models, Rainfall, Drainage, Sensitivity analysis, Optimal devision, Poisson model, Opportunity loss, Non-constant loss function, Model choice.

Demonstrated is the use of Bayesian decision theory in hydrologic design from the following viewpoints: (1) hydrologic decision-making under natural and sample uncertainty; (2) economic evaluation of the worth of perfect information; (3) economic evaluation of the worth of additional sample points; and (4) sensitivity analyses on hydrologic model choice and on economic model choice. This approach is presented by means of a very simple yet realistic example which provides the advantage that close form solutions can be obtained and evaluated numerically by hand. It is concluded that Bayesian decision analysis always leads to a correct decision. Economic uncertainties may be analyzed by Bayesian methods whenever an uncertain economic parameter may be identified. (Bell-Graf--Cornell)
W80-01696

ASSESSMENT OF THE ENVIRONMENTAL INFRASTRUCTURE REQUIRED BY LARGE PUBLIC AND PRIVATE INVESTMENTS,
Harvard Univ., Cambridge, MA. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 5C.
W80-01699

SPACE-CORRELATION FIELDS OF PAN EVAPORIMETER NETWORK,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2D.

W80-01831

MANY USES AND MANY USERS: SOME DESIRABLE CHARACTERISTICS OF A COMMON LAND AND WATER CLASSIFICATION SYSTEM,
Utah State Univ., Logan. Dept. of Forestry and Outdoor Recration.
For primary bibliographic entry see Field 7B.
W80-01898

THE DILEMMA OF STREAM CLASSIFICATION,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 2E.
W80-01899

LAKE CLASSIFICATION--GOOD AND BAD,
Arizona State Univ., Tempe. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W80-01900

CLASSIFICATION OF COASTAL ENVIRONMENTS,
Conservation Foundation, Washington, DC.
J. Clark.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 79-102, 1978. 11 Fig, 1 Tab, 12 Ref.

Descriptors: *Systematics, *Coastal areas, Shores, Dunes, Beaches, Flood plains, Watersheds, Wetlands, Aquatic habitats, Estuarine environment, Bays, Embayments, Lagoons, Topography, Soils, Vegetation, Geology, Hazards, Storms, Flooding, Erosion, Wildlife.

Ecologically comprehensive classification of coastal and marine habitat requires complete understanding of the physical and biological processes involved. The coastal zone is separated into two subsystems: shorelands and coastal waters. The terrestrial coast is regionalized into natural ecosystems types: watershed, flood plain, wetland, shoreland, dune, beachfront, and all ecotones between such areas and the aquatic environment. Coastal waters are subcategorized into estuarine, bay, embayment, lagoon, nearshore and oceanic regimes, including pertinent ecotones. Nine areas are described for comprehensive inventory data collection: topography, soil vegetation, geology, hazard areas, critical habitat, vital areas, hydrology, and wildlife and other valuable resources. Ecosystem management must be done full knowledge of the natural system and its elments. (See also W80-01897) (Otello-Mass)
W80-01901

INSULAR AQUATIC ECOSYSTEMS: HAWAII,
Hawaii Cooperative Fishery Research Unit, Honolulu.
J. A. Maciolek.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 103-121, 1978. 1 Tab, 13 Ref. 2 Append.

Descriptors: *Hawaii, *Ecosystems, *Aquatic environment, *Systematics, *Aquatic life, *Aquatic habitats, Running waters, Lakes, Wetlands, Estuaries, Ponds.

Extensive field studies by the Hawaii Cooperative Fishery Research Unit provided a base for a provisional, functional classification of all Hawaiian surface waters exclusive of the marine ecological system. Traditional physiochemical features and characteristic biota are employed in the designation of 14 ecosystem types comprising 4 flowing water types, 3 lacustrine types, 4 palustrine (wetland) types, 2 estuarine types, and a unique mixohaline coastal ecosystem in recent lava fields--anchialine pools. Eight of the types are freshwater, and 6 are mixohaline; 11 of them are natural and 3 are manmade. Abundance of each type, mostly estimated, is given. Appendix information includes descriptive summaries of environmental features and biota of each ecosystem and thier distributions are shown on maps of the five largest islands. (See also W80-011897) (Otello-Mass)
W80-01902

THE IUCN DIRECTORY OF WETLANDS OF INTERNATIONAL IMPORTANCE,
International Union for Conservation of Nature and Natural Resources. Arles (France).
E. Carp.
In: Classification, inventory, and analysis of fish and wildlife habitat--the proceedings of a national symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 137-144, (1978), 7 ref.

Descriptors: *Wetlands, *Foreign countries, *Systematics, *Conservation, Marshes, Bogs, Rivers, Lakes, Peat, Management, Education, Recreation, Projects, Population.

The IUCN Directory's goal is to identify and obtain recognition of wetlands of international importance. IUCN co-sponsored these three projects with the purpose of evaluating the importance of wetlands: MAR which dealt with the conservation and management of temperature marshes, bogs, and other wetlands; AQUA which deals with the conservation of aquatic habitats and aims to list mainly rivers and lakes selected for their limnological and hydrobiological qualities, and TELMA dealing with the conservation of peat-forming formations. The Directory's set-up includes criteria for the selection of sites and the classification system, a list and map for each country, plus a few paragraphs about the general situation of sites of international importance in that country. The Directory defines a wetland and states criteria for: the selection of wetlands of international importance; a wetland's importance to populations and specis; the selection of representative or unique wetlands; the research, educational, and recreational values of wetlands; the practicality of conservation and management. Classification of wetland types include: open sea shallow waters, sea bays, rivers and flood plains, storage reservoirs, lakes, mires, temporary waters, and artifical ponds. (See also W80-01897) (Otello-Mass)
W80-01903

U. S. FISH AND WILDLIFE SERVICE WETLAND CLASSIFICATION--STATUS, 1977,
Fish and Wildlife Service, Jamestown, ND. Northern Prairie Wildlife Research Center.
L. M. Cowardin.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedins of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-77/76, p 165-172, 1978. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Systematics, *Wetlands, *United States, Lakes, Estuaries, Rivers, Sea water, Dominant organisms.

A progress report on current wetland classification efforts within the U.S. Fish and Wildlife Service is presented along with a justification for the need for a new national wetland classification. The new classification's goals are: sufficient breadth to cover all types of land that have been traditionally called wetlands as well as permanently flooded areas that were sometimes included and sometimes excluded from earlier classifications; hierarchical structure which enables the user to choose the degree of detail appropriate to needs, available knowledge, or feasibility for inventoris; and incorporate detailed definitions at all levels to insure standardization and uniform application. Problems are discussed. The categories of the new wetland classification are: system, subsystem, class, subclass, and dominance class. Systems include marine, estuarine, lacustrine, riverine, and palustrine. All the systems except palustrine are divided into subsystems: subtidal or intertidal. Below subsystems, wetlands are assigned classes based on appearance by aerial photography. The subclasses include broad-leaved evergreen, needle-leaved evergreen, broad-leaved deciduous forested wetlands. Dominance classes are based on the dominat plant or sedentary animal species of wetland. (See also W80-01897) (Otello-Mass)
W80-01904

A DIGITIZED CLASSIFICATION SYSTEM FOR THE NATURAL VEGETATION OF NORTH AMERICA WITH HIERARCHICAL SUMMARY FOR WORLD ECOSYSTEMS,
Arizona Game and Fish Dept., Phoenix.
D. E. Brown, C. H. Lowe, and C. P. Pase.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 187-220, 1978. 13 Fig, 7 Tab, 41 Ref.

Descriptors: *Systematics, *Vegetation, *Ecosystems, *Foreign counries, Computers, Biomes, Biological communities, Biogeography, Climatic zones, Plant groupings, Dominant organisms.

The need for a hierarchical and systematic classification for ecosystems is presented with a proposed classification system based on evolutionary criteria that determine the history, adaptations, structure and composition of plant and animal communities, and that ranks natural vegetation into systematized natural sets. Examples of a digitized computer compatible classification to the 4th (= biome) and 5th (= community) levels of the system are given for Nearctic and adjacent Neotropical North America. (See also W80-01897) (Otello-Mass)
W80-01905

EVALUATION OF HABITAT QUALITY IN WYOMING TROUT STREAMS,
Wyoming Game and Fish Dept., Landers.
N. A. Binns.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 221-242, 1978. 2 Fig, 2 Tab, 7 Ref, 8 Append.

Descriptors: *Wyoming, *Trout, *Stream fisheries, *Cold-water fishing, *Aquatic habitats, *Evaluation, Stream flow, Standing crop, Velocity, Bank stabilization, Fish food organisms, Nitrates, Water temperature.

In response to Federal requirements for non-monetary evaluation of water development projects, a rating system was developed to quantify habitat quality in trout steams in the Rocky Mountains. Twenty-one environmental attributes were measured at 20 study sites in Wyoming and the relationship between attributes and trout standing crop was explored by multiple regression analysis. Ten attributes were significantly related to trout biomass and were used to develop a predictive model of habitat quality, the Habitat Quality Index (HQI). Attributes used in the HQI were: late summer stream flows, annual stream flow variation, stream velocity, cover, stream width, streambank stability, fish food abundance and diversity, nitrate concentration, and maximum summer stream temperature. (See also W80-01897) (Otello-Mass)
W80-01906

A DATA COMPILATION PROGRAM FOR WETLAND EVALUATION,
Beak Consultants, Inc., Portland, OR.
J. K. Dueker, and T. W. Haislip, Jr.
In: Classification, inventory, and analysis of fish and wildlife habitat-the proceedings of a national symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS/-78/76, p 331-350, 1977. 13 Fig, 22 Ref.

Descriptors: *Systems analysis, *Management, *Data collecting, *Data storage and retrieval, *Data processing, *Data transmission, Computers, Computer programs, Wetlands.

A compilation was designed to select, organize, and present biological data relevant to wetland evaluation. A test of this program was conducted on a data-rich wetland, the Harney Basin area of Oregon. Then a search for computer data management systems was conducted to meet the National

Wetlands Inventory's needs. The basic proposed data organization divides the biological type into vegetation or animal. Each of these divisions are in turn subdivided into group and species, and measures. (See also W80-01897) (Otello-Mass)
W80-01907

HABITAT SCARCITY, A BASIS FOR ASSIGNING UNIT VALUES FOR ASSESSMENT OF AQUATIC WILDLIFE HABITAT,
Missouri Dept. of Conservation, Jefferson City.
J. P. Fry, and W. L. Pflieger.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-24, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 491-494, 1978. 3 Ref.

Descriptors: *Evaluation, *Aquatic habitats, *Missouri, Fish, Streams, Systematics.

Current methods, for numerical evaluation of wildlife habitat, measure habitat suitability for selected species, weighted toward those important for uses such as hunting and fishing. Evaluation should address future optional needs as well as identified uses. Security of a species is inversely related to scarcity of its habitat, thus relative scarcity of a habitat type is a measure of the types important for future management options. A system for describing and assessing aquatic habitat in terms of relative scarcity and condition is being developed in Missouri. The fish fauna and a few physical factors will be used to delimit stream habitat types. Index values will be computed for each type based on its abundance and condition. Unit values of degraded habitat could be increased by habitat restoration as an exchange, for unit value losses caused by water resources projects, using habitat scarcity and condition as the primary basis for determining the location and amount of exchange. (See also W80-01897 (Otell0-Mass)
W80-01908

INVENTORY AND DISPLAY OF AQUATIC HABITAT,
Forest Service, Anchorage, AK.
A. W. Collotzi, and D. K. Dunham.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a Natural Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 533-542, 1978. 1 Fig, 3 Tab, 7 Ref.

Descriptors: *Aquatic habitats, *Census, *Systematics, *Streams, Ponds, Depth, Plants, Velocity, Streambeds, Banks, Riparian plants, Stability, Soil classification, Slopes.

A systematic and uniform approach to the inventory and display of aquatic habitat has been developed in the Intermountain Region of the U.S. Forest Service. A line transect method constitutes the inventory of aquatic habitat by measuring habitat variables that are grouped into three habitat categories: water surface, streambottom, and streambanks. A rating score for stream habitat variables is displayed for interpretation and analysis based on pool measure, pool structure, stream bottom, and stream environment. A land classification system for the valley bottom lands provides for the display of the aquatic resource at various levels of planning, and for the interaction of all resources within the valley bottom. This classification consists of four hierarchical levels: subsection, valley bottom association, valley bottom type, and valley bottom phase--the association level being the most important. (See also W80-01897) (Otello-Mass)
W80-01909

A MODELING APPROACH TO EVALUATE TIDAL WETLANDS,
Gruman Ecosystems Corp., Bethpage, NY.
For primary bibliographic entry see Field 2L.
W80-01927

COASTAL WETLANDS VALUE STUDY IN MICHIGAN: PHASE I AND II,
Eastern Michigan Univ., Ypsilanti. Dept. of Geography and Geology.
E. Jaworski, C. N. Raphael, D. L. Tilton, R. H. Kadlec, and B. R. Schwegler.
Report prepared for Michigan Department of Natural Resources, Division of Land Resource Programs, 1978. Phase I, 209 p. Phase II, 98 p.

Descriptors: *Wetlands, *Michigan, *Reviews, *Economics, *Productivity, Coastal marshes, Value, Wildlife habitat, Fish habitat, History, Cycling nutrients, Hydrology.

Phase I research consisted of a literature review of available source materials concerning wetlands values, analysis of data by geographic area, and map comparisons to document the historical loss of depicted coastal wetland vegetation. Phase II, also a literature review, addresses the values and characteristics of coastal wetlands for soils, sedimentation, energy flow, primary productivity, invertebrate and forage fish production, nutrient cycling, hydrology, and an economic analysis of some of these functions. (Steiner-Mass)
W80-01930

CASE STUDY OF THE DEMAND/SUPPLY RELATIONSHIP FOR THE INDUS RIVER BASIN,
National Engineering Service, Lahore (Pakistan).
S. M. H. Bokhari.
Water Supply and Management, Vol 3, No 2, p 77-115, 1979. 6 Fig, 16 Tab, 18 Ref.

Descriptors: *Water supply, *Water demand, *Water supply development, *River basin development, *Regional economics, *Water resources development, Planning, Social aspects, Economic impact, Indus River Basin, Water conservation, Inter-Basin transfers, Linings, Multiple-purpose projects, Water storage.

The relationship between the water supply and demand of the Indus River Basin, one of the major river basins in the Indo-Pakistan subcontinent, has not previously been established in either physical or financial terms. Although a comprehensive inventory of the basin's surface, ground and natural precipitation water is presented here, water resource development in the Indus Basin has not taken place in an integrated manner and adequate data and methodologies are not available in any standard form for aggregation of total water demand in the public or private sectors. No correlation has or can then, be established with certainty between water supply and actual demand for the present, although an empirical relation is derived here based upon a number of assumptions regarding technical and socio-economic conditions. A number of policy options for water resource developments within the basin are suggested, including conservation, lining of canals, precise land levelling, inter-basin transfers, construction of off-channel storage, population redistribution, and a shift in planning to multipurpose water projects. (Tickes-Arizona)
W80-01956

PROCEDURES IN ESTIMATING BENEFITS OF WATER QUALITY CHANGE,
Wisconsin Univ.-Madison. Div. of Natural Resources Economics.
N. W. Bouwes, and R. Schneider.
American Journal of Agricultural Economics, Vol 61, No 3, p 635-639, August 1979. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Benefits, *Water quality control, *Methodology, *Project feasibility, Cost-benefit analysis, Model studies, Lakes, Costs, Theoretical analysis, Water users, Water quality, Pike Lake(WI).

A method for estimating whether benefits derived from preserving a current high level of water quality can justify costs is addressed by: (1) describing the theoretical basis for the empirical analysis; (2) establishing the relationship between an objective measurement of water quality utilized by water resource experts and the subjective ratings of lake users; (3) presenting a model which includes recreation users' ratings of water quality; and (4) synthesizing these components and applying them to a hypothetical decision making situation. In the hypothetical example, the water quality in Pike Lake, Wisconsin is rapidly deteriorating due to large nutrient loads from storm sewers which empty directly into the lake. This decline can be prevented by construction of a storm sewer diversion at a fixed cost of $175,000. Using the developed methodology the current resource value, the impact on users' perceptions of the potential decline in water quality, and the decline in resource value that would be avoided, are determined. Assuming a 20 year period and 10% discount rate, the benefit is shown to be $331,740 well over the expected cost of the Project. (Luedtke-Wisconsin)
W80-01960

INVESTMENT SEQUENCING AND ALLOCATION DECISIONS IN WATER RESOURCE SYSTEM DESIGN: A NOTE ON AN ALTERNATIVE ALGORITHM,
Texas Univ. at Austin. Center for Cybernetic Studies.
R. D. Armstrong, and C. E. Willis.
Water Resources Research, Vol 15, No 5, p 1273-1274, October 1979. 9 Ref.

Descriptors: *Algorithms, *Water allocation(Policy), *Investment, Planning, Mathematical models, Computer models, Optimization, Computer programs, Decision making.

An algorithm to handle computational problems of large scale mathematical models required for simultaneous consideration of water investment planning and water allocation decision is presented. Rausser and Willis (1976) developed an empirical application which incorporated investment sequencing with allocation components. However, no computer program was available which could handle a nonlinear ojective function with mixed-integer variables, and they used an iterative decomposition procedure to permit the two components to interact. This iterative procedure resulted in convergence to a local optimum, but could not guarantee global optimality without listing all possible investment alternatives. The algorithm described is a generalization of the decomposition method of Benders for linear mixed-integer programming problems. It solves the Rausser and Willis problem, converging to the optimal solution, and requires less computer time. (Luedtke-Wisconsin)
W80-01961

DIAGRAMMATIC REPRESENTATION OF THE EXPLOITATION OF REPLENISHABLE NATURAL RESOURCES: DYNAMIC ITERATIONS,
York Univ., Downsview (Ontario). Dept. of Economics.
C. Plourde.
Journal of Environmental Economics and Management, Vol 6, No 2, p 119-126, 1979. 5 Fig, 26 Ref.

Descriptors: *Fish harvest, *Model studies, *Graphical analysis, Renewable resources, Planning, Costs, Risks, Curves, Theoretical analysis, Optimization, Resources development, Development, Management, Consumption, Exploitation.

Geometric representations of two dynamic models of replenishable natural resources harvesting are illustrated. The first is a simple case in which a natural resource product, fish, is extracted without cost in terms of effort or expenditure of capital from a biomass of resource stock. Diagrams are used to illustrate long and short-run tradeoffs between present consumption and future stocks. The evolution of this resource stock is traced from any initial state to an optimal long-run steady state. Discounting and uncertainty are also considered. The second model uses a four-quadrant diagram to show a transition similar to the first when there are production costs such as labor. This adds another good to the model and makes the geometry much more elaborate. The four-quadrant diagram illustrates a short-run equilibrium and the dynamics that lead to a long-run solution on the bionomic transformation curve. (Luedtke-Wisconsin)

W80-01964

ECONOMIC VALUE OF FISH, WILDLIFE, AND RECREATION IN MICHIGAN'S COASTAL WETLANDS,
Eastern Michigan Univ., Ypsilanti. Dept. of Geography.
C. N. Raphael, and E. Jaworski.
Coastal Zone Management Journal, Vol 5, No 3, p 181-194, 1979. 5 Tab, 28 Ref.

Descriptors: *Wetlands, *Value, *Economics, *Sport fishing, *Recreation, *Wildlife, *Michigan, Hunting, Fishing, Commercial fishing, Market value, Evaluation, Pricing, Coasts, Trapping, Social aspects, Return(Monetary), Benefits.

Gross annual return from Michigan's 105,855 acres of coastal wetlands is estimated on the basis of annual expenditures by recreational participants, standard values of recreation days, and estimated sport and commercial harvests, as part of the Coastal Wetland Value Study. These wetlands generated $489.69/acre for a direct annual gross of $51.8 million in 1977. Average return values per acre by activity were (1) sport-fishing: $286.00; (2) nonconsumptive recreation: $138.24; (3) waterfowl hunting: $31.23; (4) trapping of furbearers: $30.44; and (5) commercial fishing: $3.78. Inclusion of other values such as flood control, groundwater recharge, visual-cultural, sediment trapping, and nutrient uptake which may not be vendable in the marketplace could increase the average return to well over $3,000 acre/year. Regions evaluated included Saginaw Bay with 33,380 acres, Lake Michigan with 29,846 acres, Lake St. Clair and the St. Clair River with 15,630 acres, Lake Erie with 6,715 acres, Lake Huron with 5,685 acres, the Detroit River with 1,420 acres and Lake Superior with 2,200 acres. Phase 2 of the Coastal Wetland Value Study will emphasize the nonvendable aspects of wetlands. (Luedtke-Wisconsin)
W80-01965

THE SIMULATION AND OPTIMIZATION OF A MULTI-BASIN WATER RESOURCE SCHEME IN CYPRUS,
London Univ. (England).
J. K. White, and C. A. Christodoulou.
Proceedings: The Institutions of Civil Engineers, Part 2, p 111-132, March 1979. 5 Fig, 2 Tab, 5 Ref.

Descriptors: *Model studies, *Optimization, *Water supply, *Water resources development, Cyprus, Watershed management, Planning, Multiple purpose projects, Rivers, Reservoirs, Catchments, Methodology, Economics, Decision making, Simulation models.

Planning for water supply development in the southern part of Cyprus is described to illustrate a simulation model of a multi-dimensional coastal system which successfully optimized values of an objective function having 41 decision variables. The system consists of 18 rivers and six major aquifers grouped in nine projects. To meet projected irrigation and domestic demands, constructions sites for six new diversions, and 12 new reservoirs and a conveyor route consisting of 11 open channels have been selected. Capacities of each components were determined by optimizing the economic evaluation of a water balance simulation model. The 41 required decision variables consisted of the capacities and timings of construction of critical system components. System parameters of the Cyprus model include water supply characteristics, economic considerations and a 50 year period of analysis composed of discrete time intervals of one month. Results show that the optimal capacity for reservoir no. 9 which is at the heart of the Cyprus system is 90-100 million cu m and should be constructed in the fourth year. Proposed reservoirs no. 7, 8, and 19 appear to be unnecessary. (Luedtke-Wisconsin)
W80-01968

EQUITY IN COASTAL ACCESS: INCOME AND SPATIAL EFFECTS OF THE BENEFITS OF A NEW BOAT HARBOR IN METROPOLITAN LOS ANGELES,
Center for Natural Areas, Oakview, CA.
P. J. Symonds.
Coastal Zone Management Journal, Vol 5, No 1/2, P 83-106, 1 Fig, 5 Tab, 22 Ref. NOAA 04-5-158-36.

Descriptors: *Recreation demand, *Marnas, *California coastal plan. *Equity, *Benefits, Equitable apportionment, Spatial distribution, Coasts, California, Los Angeles(CA), Construction, Model studies, Income, Environmental effects, Recreation facilities, Wetlands, Boating, Statistical analysis, Planning, Social participation.

Distribution of benefits among income groups around Los Angeles of additional marina construction along the Southern California coastline is analyzed in the context of the recreational boating policies in the California Coastal Plain of 1975. This plan: (1) echoes widespread belief in a continuing unmet demand for boating facilities through the next decade; (2) notes that construction of boating facilities would be environmentally damaging to coastal wetlands; and (3) recommends more frequent use of existing facilities and construction of dry-storage and launching facilities. The plan deals with efficiency questions, but does not consider the issues of equity of access to the resources. Using an empirical estimation of income, spatial, and facility-supply effects on boat ownership, relative distribution of benefits by income and location of new facilities construction is inferred. The need for an analysis of intrametropolitan as opposed to interregional boat ownership is assessed. Household income, residence-to-facility distance, and facility-capacity indicators are suitable predictors of boat ownership and are corporated into a probability model. Demand for new boating facilities is dependent on high family income and distance to the facility, factors which could limit such demand. Th primary benefits of new facility construction would accrue to households in the upper one-tenth of the regions' income bracket, especially those living near the coast. (Luedtke-Wisconsin)
W80-01969

ECONOMICS AND WATER CONSERVATION,
Department of the Interior, Washington, DC. Office of Minerals Policy and Research Analysis.
R. K. Schaefer.
Water and Sewage Works, Vol 126, No 6, p82-86, June 1979. 5 Tab.

Descriptors: *Water conservation, *Economics, *Water demand, Water rates, Toilets, Water supply, Waste water treatment, Water utilization, Water treatment, Cost-benefit analysis, Cost effectiveness, Water users, Shower heads, Washing machines, Facets, Federal Water Pollution Control Act Amendments of 1972, PL 92-500.

Economic analysis for water conservation is explored. Inerest in water conservation has recently increased with passage of the 1972 Federal Water Pollution Control Act Amendments requiring expensive wastewater treatment. Other factors include energy crisis, climate conditions which have reduced water suplies to some heavily populated areas, rapid escalation of costs for developing water supplies including expensive treatment requirements of the Safe Drinking Water Act, and alternative water resources use conflicts. Water conservation plant must include analysis of industrial and domestic consumer use patterns together with price information, available physical and social alternatives, and innovative water suply and wastewater treatment options. Economic analysis of water conservation alternatives also requires that the cost per unit of new capacity be compared with the cost per unit of saving due to conservation. In practice, combinations of education, laws or regulations, devices such as low-flow shower heads, and pricing techniques are used to achieve water conservation. The cost-effectiveness of each must be analyzed to determine a project's value. Tables listing water demand factors and costs and savings of water conserving devices are included. (Luedtke-Wisconsin)
W80-01970

BENEFIT-COST ANALYSIS FOR APPRAISAL OF RECREATION ALTERNATIVES,
North Central Forest Experiment Station, Chicago, IL.
J. F. Dwyer, and M. D. Bowes.
Journal of Forestry, Vol 77, No 3, p 145-147, March 1979, 14 Ref.

Descriptors: *Cost-benefit analysis, *Forests, *Land resources, *Benefits, *Model studies, *Recreation demand, *Willingnes-to-pay, Recreation, Natural resources, Conservation, Land use, Parks, Costs, Economics,Social needs, Travel time, Social behavior, Social values, Social participation, Decision making, Waterfowl.

This paper outlines a methodology for estimating recreation benefits by measuring willingness of users to pay; estimations can be made either by participation behavior of recreation users or by surveying a sample of participants to learn their preferences. Each acre allocated to wilderness costs society stumpage value that could have been harvested from that land. Rather than make arbitrary decisions, managers of public lands can estimate society's willingness to make such trades. Two general methods are: (1) the travel-cost approach for estimating regional demand, and (2) the survey-based method. The former estimates willingness-to-pay from actual participant demand behavior; in the survey method, participants state their degree willingness. The travel-cost method is preferable since it is based on what people do, rather than what they say they will do. Past model construction efforts indicate user behavior and recreation values can be estimated from a small number of variables. One model which predicts the value of waterfowl hunting includes household income (after taxes), number of waterfowl hunting seasons, cost of a season's hunting, waterfowl short and bagged during the season, and number of hunting days during the season. Existing procedures for estimating recreation benefits make it possible to use benefit-cost analysis to evaluate management alternatives. (Danovich-Wisconsin)
W80-02000

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

A MODELING APPROACH TO EVALUATE TIDAL WETLANDS,
Gruman Ecosystems Corp., Bethpage, NY.
For primary bibliographic entry see Field 2L.
W80-01927

AN EFFLUENT CHARGE SCHEDULE: COST, FINANCIAL BURDEN, AND PUNITIVE EFFECTS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
E. D. Brill, Jr., C. Revelle, and J. C. Liebman.
Water Resources Research, Vol 15, No 3, p 993-1000, October 1979. 7 Fig, 4 Tab, 14 Ref. 5T01EC00023.

Descriptors: *Economic efficiency, *Pollution taxes(Charges), *Effluent charge schedule, *Constant unit effluent charge, *Costs, Equity, Delaware, Water quality control, Punitive effects, Financial burden, Economic feasibility, Management, Waste water treatment, Dissolved oxygen, Effluents, Effluent charges.

Constant-unit effluent charge programs and effluent charge schedule programs are compared with regard to cost, charge payments, financial burden, and punitive effects. Data for the Delaware Estuary show that these programs vary considerably and that the charge schedule programs reduce the charge payments and financial burden significantly. While constant-unit charge programs exact much lower cost penalties than corresponding uniform treatment programs, they also require total charge payments of the same magnitude as the total removal cost. These charge totals are an income transfer and their sum constitutes the financial burden. Effluent charge schedule programs reduce this burden by decreasing the charge per unit as the level of waste discharge decreases. This is because the unit charge function lies below the marginal saving function, which also contains a

component for the decreasing value of the unit charge. In the Delaware example, charge schedule programs indicated a 33 percent reduction in the total financial burden and a 70 percent reduction in the charges paid. The sum of the total cost plus charges paid is less than or about the same as the total cost of waste removal alone for the corresponding direct regulation programs, maintaining the economic efficiency advantage while reducing the financial burden. It is noted that a significant part of the charge component of the burden, 30% to 80% of the total charges for constant charge programs is punitive in nature. (Luedtke-Wisconsin)
W80-01962

PHOSPHATE BAN LOWERS REMOVAL COSTS,
Escanaba Wasterwater Treatment Plant, MI.
R. Jacke.
Water and Wastes Engineering, Vol 16, No 8, p 33-35, August 1979. 3 Fig, 2 Tab.

Descriptors: *Phosphates, *Waste water treatment, *Costs, *Phosphorus removal, *Cost analysis, Escanaba(MI), Michigan, Phosphate ban, Ferric chloride, Polymer, Treatment facilities.

Comparison of operational data from the Escanaba Wasterwater Treatment Plant January-October 1977 and the same months in 1978 show that a phosphate ban in Michigan has reduced phosphate concentration in wastewater, thereby significant lower its removal costs. Average total phosphorus influent dropped from 10.6 mg/1 in 1977 to 6.1 in 1978 with implementation of a 5% total phosphorus limit in laundry detergents. As the phosphorus influent decreased, quantities of ferric chloride and polymer needed to maintain the 80% removal standard were reduced. Monthly average ferric chloride required dropped from 13, 516 lb/month to 8, 437 lb/month while polymer useage dropped from 155 lb to 108 lb. This resulted in an average monthly cost/mg reduction from $27.99 to $18.99 and a total average cost reduction from $1,448 to $1,029/mo. Initial data also indicate that sludge production due to phosphorus has been cut by 59,709 lb over the 10mo period saving an additional $1,582 in sludge disposal costs. (Luedtke-Wisconsin)
W80-01971

6D. Water Demand

FORECASTING THE NEED FOR SURFACE WATER USE CONJUNCTIVE WITH GROUNDWATER,
Mississippi State Univ., Mississippi State. Bureau of Business and Economic Research.
R. L. Frnka, and L. R. Cheatham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116320, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Report, September 1979. 91 p, 11 Fig, 10 Tab, 26 Ref. OWRT B-018-MISS (1), 14-34-0001-8093.

Descriptors: *Capital costs, *Economic feasibility, *Electric power costs, *Operating costs, *Water demand, Filters, Forecasting, Groundwater supply, Planning, Reservoirs, Regression analysis, Surface water supply, Water wells, *Chemical costs, *Labor costs, *Mississippi municipalities, Chlorinators, Integrated water supply.

The objective was to provide a planning model for integrating surface water production into ground water supply systems for the major municipalities in Mississippi. With the use of multiple regression techniques municipal water demand was estimated to be a function of population, industry profile and climatic factors. Forecasts for water requirements were made for future years. Primary data on operation costs and capital costs were obtained from personal interviews from over forty municipalities. Projections of these costs necessary to meet the respective demands for each municipality were made by considering the use of present ground water systems and hypothetical surface water systems. A comparison of costs between the two alternatives was used to determine the feasibility of integrating surface water to ground water production. In general the reduced electric utility costs of surface systems were not adequate to counter their increased chemical and labor costs. However, in a few cases an integrated water system might be feasible if an existing surface water source could be enhanced at a considerable low cost.
W80-01606

EFFECT OF WATER CONSERVATION ON WATER DEMANDS,
Brown and Caldwell, Walnut Creek, CA.
W. O. Maddaus, and D. L. Feuerstein.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR2, p 343-351, September 1979. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Water conservation, *Water plans, *Water demand, *Water consumption, Water utilization, Land use, Regional planning, Water distribution(Applied), Water supply, Methodology, Effects, Estimating, Costs, Programs, Employment, Residential water.

A new method for predicting long-range waer demands was developed to quantify the post-drought effectiveness of water conservation in the San Francisco Bay Area. The method used general relations between water use and population density and employee density that were derived for the Bay Area. Several alternative water conservation programs were tested using the projection model and the resulting water savings ranged from 4% to 16% by the year 2000. The costs of water conservation were compared with those for building new water supply projects. It was concluded that water conservation was more cost-effective than other sources of water supply. (Bell-Graf--Cornell)
W80-01692

EQUITY IN COASTAL ACCESS: INCOME AND SPATIAL EFFECTS OF THE BENEFITS OF A NEW BOAT HARBOR IN METROPOLITAN LOS ANGELES,
Center for Natural Areas, Oakview, CA.
For primary bibliographic entry see Field 6B.
W80-01969

MARINE RECREATION IN THE COASTAL BELT,
Rhode Island Univ., Kensington.
N. Rorholm.
Marine Technology Society Journal, Vol 13, No 2, P 26-29, April/May 1979. 2 Tab, 3 Ref.

Descriptors: *Recreation, *Coasts, *Planning, *Resource allocation, Decision making, Regional economics, Management, Water resources development, Sea water, Beaches, Boating, Swimming, Costs, Taxes, Alternative planning, Recreation demand, Pricing.

The need to more fully analyze the nature of marine recreational activity and to provide a rational basis for resource allocation in the coastal belt (coastal zone plus economic zone) is described. Marine recreation activities are difficult to manage because: (1) they occur both on land where private property rights are definable and partly in water, which is public domain; (2) quality of recreational experience is dependent on various regulative activities; and (3) many different kinds of recreation experiences are desired and these require a wide range of resource combinations. Information is needed on the role of recreation in keeping physically and mentally fit and on the particular aspects of recreation which affect these processes. In addition it is necessary to know the production processs including spillovers and externalities such as employment and income effects since recreation is often used as a tool for regional economic development. A partial list of productive factors for selected types is illustrated. Future growth and conflicts in marine recreation will have to be handled by allocation policies; participation does seem densitive to disposal income changes. Conflicts will arise from recreational versus commercial uses of the seas, competition between indivisuals who live in an areas versus those who make their living from tourism, and from crowding of individual recreation activities such as boating. (Leudtke-Wisconsin)
W80-01972

CURRENT USE OF WATER SURFACE ZONING FOR RECREATION,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Natural Resources.
For primary bibliographic entry see Field 6A.
W80-01973

BENEFIT-COST ANALYSIS FOR APPRAISAL OF RECREATION ALTERNATIVES,
North Central Forest Experiment Station, Chicago, IL.
For primary bibliographic entry see Field 6B.
W80-02000

6E. Water Law and Institutions

WATER SUPPLY AND CONTROL DEVELOPMENT - COLORADO,
Form the State Capitals, p 1-2, September 1, 1979.

Descriptors: *Water rights, *Colorado, *Grand water, *Judicial decisions, Water allocation(Policy), Water law.

In a unprecedented water rights case, 121 claims to Colorado's non-tributary, underground water supplies will be decided. Deliberations will begin after the Colorado Supreme Court clarifies certain questions of law. Opposing the claimants are the federal government, the state of Colorado, many cities in the state, a variety of businesses and industries, and several groups of ranchers, farmers, land developers and individuals who claim that water supplies could be adversely affected by development of the water claims. It may take several years before a final ruling in the case is obtained. (Purdin-MWWA)
W80-01740

NAVIGATION USER CHARGES: IMPACT ON THE TRANSPORTATION OF AGRICULTURAL PRODUCTS,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
J. Binkley, L. Shabman, J. Havlicek, W. Luppold, and R. Stillman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119449, Price codes: A06 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Bulletin 121, October 1979. 97 p, 6 Fig, 18 Tab, 46 Ref. OWRT B-082-VA(4).

Descriptors: *Navigation, *Water policy, *Transportation, *Inland waterways, *Taxes, Fuels, Effects, Agronomic crops, *Waterway user charge, Fuel tax, Economics.

The inland waterways of the United States historically have been maintained and improved by the federal government at no cost to waterway users. However, in 1978 legislation was enacted that imposed a fuel tax on commercial waterway traffic. The debate over this legislation raised concerns that such charges could reduce significantly the freight tonnage carried on the inalnd waterway system and could affect adversely major industries dependent upon water transportation. This research assessed the likely impact of such a charge on the movement of grains and the location of the broiler chicken industry. The results of the analysis suggest that a uniform charge administered as a fuel tax on all waterways would have a small impact on grain movements by barge if full federal operation and maintenance costs are recovered. The recent legislation, which requires a lower fuel tax level, would have virtually no effect on grain movements by barge. A toll tied to recovery of operation and maintenance costs of a particular waterway segment would reduce traffic on the

high-cost waterways, but such traffic represents only a small proportion of the total movements. The results indicate also that any changes in prices for delivered grain that might be brought about by a user charge would not be of sufficient magnitude to affect the broiler industry, whose location and distribution patterns are sensitive to costs of feed grain transportation.
W80-01795

ECOLOGY AND ECONOMICS IN LAGOS STATE,
Ibadan Univ. (Nigeria). Dept. of Geography.
For primary bibliographic entry see Field 6A.
W80-01966

CURRENT USE OF WATER SURFACE ZONING FOR RECREATION,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Natural Resources.
For primary bibliographic entry see Field 6A.
W80-01973

6F. Nonstructural Alternatives

FLOOD INSURANCE PROGRAM: REGIONAL AGENCY'S PERSPECTIVE,
Donohue and Associates, Inc., Waukesha, WI.
For primary bibliographic entry see Field 4A.
W80-01686

6G. Ecologic Impact Of Water Development

RESPONSE OF A LAKE WHITEFISH (COREGONUS CLUPEAFORMIS) POPULATION TO EXPLOITATION,
Fisheries and Marine Service, Nanaimo (British Columbia).
M. C. Healey.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 2019-2024. 3 Fig, 4 Tab, 10 Ref.

Descriptors: *Fish populations, *Lake Drygeese(Canada), *Lake Baptiste(Canada), *Whitefish, *Growth rates, *Fish harvest, Lakes, Canada, Growth stages, Population, Fecundity, Size, Mature growth stage, Exploitation, Correcation analysis, Age, Fish reproduction, Life cycles, Fisheries.

In Canadian Prygeese Lake, intensively exploited for whitefish (Coregonus clupeaformis) in 1973-1974, growth rate of some year classes increased significantly and young fish age 0+ and 1+ were largely recruited at exploitation times. Drygeese Lake and the control Lake Baptiste are both located near Yellowknife in the Canadian Northwest Territories. Survey catch per unit effort (CPUE) ranged 9.3-19.6 in Baptiste between 1971 and 1976. In Drygeese, survey CPUE dropped from 17.3 prior to harvest to 5.6 in 1974. During 1973-1974, 6,127 whitefish were removed from Drygeese and by the end of 1974 few whitefish were left. However, the population recovered rapidly and by 1976 CPUE increased to 10.2. As a result of exploitation, all ages show improved growth, while youngest fish show the greatest improvement. Annual growth in weight increased in Baptiste from 28% in 1967 year-class to 54% in 1973 year-class. In Drygeese, 1967 year-class increased 33% and 1973 year-class grew significantly more slower, 36%. Drygeese 1971 and 1972 year-classes grew significantly faster, 57% and 48% respectively. Exploitation in 1973-1974 virtually eliminated older fish; this was followed by a strong recruitment pulse of fish aged 2+ in 1975 and the same year-class, now 3+ in 1976. Abundance of recruits may have inhibited growth as suggested by the slow fish growth rate from the 1973 year-class. (Danovich-Wisconsin)
W80-01789

UTILIZATION OF DISSOLVED ORGANIC CARBON BY HETEROTROPHIC BACTERIA AND PROTOZOA,
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
J. M. Graham, R. P. Canale, and S. R. Allen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119498, Price codes: A04 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, East Lansing. Project Completion Report. November, 1979. 48 p, 17 Fig, 5 Tab, 24 Ref. OWRT B-047-MICH (1), 14-34-0001-7121.

Descriptors: *Continuous culture, *Predator-prey, *Heterotrophic microorganisms, Laboratory tests, Bacteria, Trophic level, Carbon cycle, Predation, Protozoa, Mathematical models, *Didinium, *Paramecium, Coulter counter.

This research has investigated in batch and continuous culture laboratory microcosms the relationships between level and turnover rate of dissolved organic carbon substrates and the interactions among microbial populations at three trophic levels in a heterotrophic predator-prey system. Four trophic levels were measured: organic carbon substrates, the bacterium Enterobacter aerogenes (ATCC 13048), grazing ciliate Paramecium primaurelia (stock 540), and predatory ciliate Didinium nastum (ATTCC 303399). A mathematical model based on Monod kinetics was developed for this system. This research indicated that the level and turnover rate of dissolved organic carbon could profoundly affect coexistence and stability of a heterotrophic system. At high nutrient levels interference among predators permit a few prey to survive and repopulate the vessels. Encystment enabled the top predators to survive until prey became abundant and a series of oscillations resulted. When nutrient levels were reduced predators no longer interfered with each other, prey were eliminated, and only bacteria remained. The mathematical model gave a reasonable qualitative description of the observed data from continuous cultures. Actual continuous culture systems were less oscillatory than predicted by the model. No batch and continuous culture studies have previously been reported with as many trophic levels as in this research.
W80-01797

ESTABLISHMENT AND GROWTH OF SELECTED FRESHWATER AND COASTAL MARSH PLANTS IN RELATION TO CHARACTERISTICS OF DREDGED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 2L.
W80-01910

STREAM CHANNEL MODIFICATION IN HAWAII. PART C: TOLERANCE OF NATIVE STREAM SPECIES TO OBSERVED LEVELS OF ENVIORONMENTAL VARIABILITY,
Hawaii Cooperative Fishery Research Unit, Honolulu.
C. B. Hathaway, Jr.
Fish and Wildlife Service Report. FWS/OBS-78/18, October, 1978. 59 p, 11 Fig, 12 Tab, 45 Ref, 1 Append.

Descriptors: *Streams, *Hawaii, *Channeling, *Effects, *Fish, Ecology, Aquatic life, Populations, Habitats, Ecological distribution, Freshwater, Temperature, Hydrogen ion concentration, Riparian land, Concrete construction.

Channel modification in Hawaii has been correlated with increases in physio-chemical variability and reductions in numbers of several endemic gobiid fishes in altered streams. The amphidromous migratory behavior of the native fauna prevents the isolation of any species from the effects of channelization on water quality. Daytime values of conductivity, pH and dissolved oxygen were found to be considerably higher in altered streams than in unaltered streams. All stations located downstream from channel modifications had higher diurnal peak temperatures than upstream and unaltered stream stations. Temperature ext4remes of 36.2C and 17.8C were recorded at the downstream end of a concrete lined channel. Diel changes in temperature of 12C were not uncommon. High illumination due to clearing of the vegetative canopy, and shallow water depths in lined channels appear to be responsible for the excessive heating. Upper lethal temperatures correlated with altitudinal distributions of adult fishes and crustaceans. Lethal limits of those species absent or rare in altered streams fell within the range of temperatures recorded in such degraded habitats. Dominant introduced fishes showed greater resistance to high temperatures than native animals. Maximum growth rates occurred in fluctuating temperatures whose diel maxima were 7-8C below upper lethal limits. (Stihler-Mass)
W80-01911

STREAM CHANNEL MODIFICATION IN HAWAII, PART D: SUMMARY REPORT,
Hawaii Cooperative Fishery Research Unit, Honolulu.
J. D. Parrish, J. A. Maciolek, A. S. Timbol, C. B. Hathaway Jr., and S. F. Norton.
Fish and Wildlife Service Report. FWS/OBS-78/19, October, 1978. 18 p, 1 Fig, 5 Tab, 5 Ref.

Descriptors: *Streams, *Hawaii, *Channeling, *Effects, *Fish, Dredging, Concrete construction, Crustaceans, Populations, Vegetation, Ecology, Ecological distribution, Biomass, Hydrogen ion concentration, Turbidity, Temperature, Substrate, Riparian land.

A three-year, statewide study was made of the occurrence and consequences of channelization in Hawaiian streams. The 366 perennial streams of the State were inventoried for the first time, and some basic information was catalogued on their physical characteristics, complete status of channel alteration, and macrofaunal communities. Fifteen percent of the State's streams have channels altered in at least 1 of 6 forms. Forty percent of the State's streams have channels altered in at least 1 of 6 forms. Forty percent of the modified channel length is concrete lined-the form of alteration found to be most ecologically damaging. Field measurements shoewed that channel alterations commonly caused large changes in pH values, conductivity, dissolved oxygen and daily temperatures. The native species tested in the laboratoty had less tolerance of high temperatures than exotics, and some natives had upper lethal temperature limits within the temperature range measured in channelized stream. Twenty-five species of fish and decapod crustaceans were collected statewide, of which only 9 were native. Native species were not abundnant in most heavily channelized sections, whereas native species were almost entirely absent. Recommendations for mitigating the impact of channel modification are included. (Stihler-Mass)
W80-01912

SALT MARSH PLANTS AND FUTURE COASTAL SALT MARSHES IN RELATION TO ANIMALS,
Delaware Univ., Newark. Dept. of Biological Sciences.
F. C. Daiber.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.), Academic Press, Inc., New York, p 475-508, 1974. 1 Fig, 5 Tab, 111 Ref.

Descriptors: *Marsh plants, *Marsh management, *Wildlife habitat, Wetlands, Salt marshes, Marshes, Halophytes, Burning, Ditches, Dikes, Mosquitoes, Impoundments, Wildlife, Distribution patterns.

A literature review is conducted of the types of salt marsh management and their effects on plant distribution and wildlife habitat. (Steiner-Mass)
W80-01923

AN OVERVIEW OF RIVER-BASIN ASSESSMENT TECHNIQUES IN AN ENERGY-IMPACTED REGION--YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Denver, CO.
T. D. Steele.

Water Supply and Management, Vol 3, No 3, p 151-171, 1979. 10 Fig, 2 Tab, 29 Ref.

Descriptors: *River basin development, *Colorado River development, *Remote sensing, *Water resources development, *Environmental effects, *Coal mines, Alternative planning, Energy, Regional development, Regional analysis, Economic impacts, Rocky Mountain Region, Comprehensive planning, Assessments, Evaluation, Data collections, Model studies, Yampa River Basin, Colorado, Wyoming.

Reported here are the results of completed basin assessment studies of the Yampa River Basin in northwestern Colorado and south-central Wyoming that had as their objectives (1) to evaluate the environmental and economic impact of regional energy and water resource development for existing and feasible alternative policies, and (2) to describe the assessment methodologies used so that they may be applied to other energy-rich regions of the western U.S. where water resources are limited. A set of 7 coal-resource development alternatives are specified in order to evaluate the effects of possible water demands and generated residuals on the region's water resources. The resultant analyses consider both the direct effects of coal mining, processing, conversion and transportation and the indirect effects of increased population and related commercial and service needs. Based upon extensive field collection of hydrologic data and the analysis of regional economic projections, a range of impacts of the projected development on the basin's water resources are evaluated using several data-analysis and physical modelling techniques. (Tickes-Arizona)
W80-01952

7. RESOURCES DATA

7A. Network Design

COMPUTER MODELS TO PREDICT GROUND WATER CHANGES,
Ground Water Age, Vol 13, No 11, p 27, 40, July, 1979.

Descriptors: *Computer models, *Aquifier systems, *Forecasting, Regional analysis, Ground water basins, Ground water movement, Water quality.

The U. S. Geological Survey has begun a program to develop computer models of the overall aquifer system of six ground water regions of the United States; the northern Great Plains region; the High Plains region; the Central Valley of California; the sandstone aquifiers of the northern Midwest, the alluvial valleys of the Southwest, and the limestone aquifers of Florida, Georgia and neighboring states. The models will aid in identifying the natural (pre-pumping) conditions and the changes brought about by human activities. They will also help in predicting the areal effects of present and future stresses, such as increase in pumping, artificial recharge, or waste disposal. (Purdin-NWWA)
W80-01682

MONITORING CHANGES IN GROUND WATER QUALITY,
For primary bibliographic entry see Field 5B.
W80-01700

MONITORING LANDFILLS,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5A.
W80-01731

FISH COMMUNITIES OF THE MANITOULIN ISLAND LAKES,
Toronto Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 8I.
W80-01791

INFLUENCE OF STARVATION ON WHITEFISH (COREGONUS LAVARETUS L.) LARVAE,
For primary bibliographic entry see Field 8I.
W80-01794

TARP GROUNDWATER MONITORING, SUMMARY REPORT (OCTOBER, 1976-SEPTEMBER, 1977),
Metropolitan Sanitary District of Greater Chicago, IL. Research and Development Lab.
For primary bibliographic entry see Field 5B.
W80-01896

7B. Data Acquisition

THE PERFORMANCE OF A WAVE GAUGE IN BUBBLY WATER--WHAT DOES IT MEASURE,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2L.
W80-01809

PERFORMANCE OF A F.R.P. PAN EVAPORIMETER,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2D.
W80-01829

LIGHT SCATTERING AND EXTINCTION IN A HIGHLY TURBID COASTAL INLET,
Harbor Branch Foundation, Inc., Fort Pierce, FL. Remote Sensing Services.
M. J. Thompson, L. E. Gilliland, and L. K. Rosenfeld.
Estuaries, Vol 2, No 3, p 164-171, September 1979. 4 Fig, 2 Tab, 17 Ref.

Descriptors: *Inlets(Waterways), *Turbidity, *Suspended solids, *Remote sensing, Coasts, Rivers, Estuaries, Light, Optical properties, Surveys, Organic matter, Chemicals, Particle size, Instrumentation, Light scattering, Light extinction.

Multifactor regression analysis was used to test for relationships between chemical, physical, and optical properties of the water column in the organically rich, highly turbid waters of Florida's Fort Pierce Inlet. Optical measurements were made at three visible light wavelengths (445 nm, 542 nm, and 630 nm). Scattering by suspended particulate material was found to be the primary optical mechanism controlling down-welling irradiance at all three wavelengths. Larger particles showed constant scattering efficiencies of 2 when their diameters exceeded 3 to 5 microns, depending upon the wavelength used for observation. Selective absorption had a definite effect on the transmission of radiant energy in the 445 nm wavelength range. High correlation between extinction at 445 nm and the cross-sectional area of the suspended particulate material indicates that particulate, rather than dissolved materials, are the major water column constituents that selectively absorb short wavelength radiant energy in this inlet. Spectral distribution of the downwelling radiant energy field was found to shift dramatically over a period of several months. These shifts in downwelling spectral irradiance were attributed to seasonal and/or event related shifts in concentrations of selectively absorbing compounds within the water column. (Sims-ISWS)
W80-01843

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5B.
W80-01865

ASSESSMENT OF AN AMPEROMETRIC MEMBRANE PROBE FOR DETERMINING FREE RESIDUAL CHLORINE IN SALINE COOLING WATERS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
N. A. Dimmock, and D. Midgley.
Water Research, Vol 13, No 11, p 1101-1104, 1979. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Cooling waters, *Chlorine, *Measurement, *Instrumentation, Equipment, Laboratory tests, Chlorination, Bromine, Salinity, Chemistry, Hydrogen ion concentration, Temperature, Water temperature, Analytical techniques, Coasts, Estuaries.

Cooling water at coastal and estuarine power stations is chlorinated to inhibit mussel growth in the intakes to the condensers, and a means of automatically monitoring the free residual chlorine concentration is desired so that the dosage can be precisely maintained at 0.2 microgram/milliliter C12. The Delta Scientific model 82124 amperometric membrane probe has been tested in the laboratory for its suitability for this application. The probe had a linear response to hypochlorous acid over the range 0-5 microgram/milliliter, but it was not specific for free residual chlorine, as chloramines also produced a response. The main product of the chlorination of seawater is bromine, to which the probe is about five times more sensitive than to hypochlorous acid. Although the probe can be calibrated with bromine, its repsonse is then much noisier than that obtained with hypochlorous acid. The salinity of the sample influencesthe reading obtained at a given concentration of oxidant: increasing the salinity increases the reading obtained with hypochlorous acid but decreases that obtained with bromine. (Sims-ISWS)
W80-01867

RELATION BETWEEN WEST COASTAL RAINFALL AND NIMBUS 6 SCAMS LIQUID WATER DATA OVER THE NORTHEASTERN PACIFIC OCEAN,
Stanford Research Inst., Menlo Park, CA.
W. Viezee, H. Shigeishsi, and A.T.C. Chang.
Journal of Applied Meteorology, Vol 18, No 9, p 1151-1157, September 1979. 5 Fig, 2 Tab, 8 Ref. NASA NAS5-24450.

Descriptors: *Remote sensing, *Rainfall, *Coasts, *Pacific Ocean, Satellites(Artificial), Data processing, Storms, Extratropical cyclones, Precipitation(Atmospheric), Microwaves, Model studies, Mathematical models, Meteorology, Nimbus 6.

A research study was described in which the application to rainfall predicition of cloud liquid water data obtained from the SCAMS experiment of Nimbus 6 was explored. The study area was the Pacific Northwest coast of the United States, where rainfall is produced by extratropical storms that approach from across the Pacific Ocean. SCAMS data related to cloud liquid water over the ocean, and coastal rainfall data were analyzed for 20 different storm systems in the northeastern Pacific Ocean; these produced significant rainfall from Washington to centeral California during the period October 1975-March 1976. Results showed that the distribution of storm-cloud water analyzed from the SCAMS data over the ocean foreshadows the distribution of coastal rainfall accumulated from the storm at a later time. It was concluded that passive microwave sensor measurements of cloud water over the ocean, when used in conjunction with numerical and other objective guidance, can be used to enhance the accuracy of predictions of coastal rainfall distribution. Limitations in the SCAMS measurements and in the data analysis and interpretation were noted. (Sims-ISWS)
W80-01889

MANY USES AND MANY USERS: SOME DESIRABLE CHARACTERISTICS OF A COMMON LAND AND WATER CLASSIFICATION SYSTEM,
Utah State Univ., Logan. Dept. of Forestry and Outdoor Recration.
L. S. Davis, and J. A. Henderson.
In: Classification, inventory, and analysis of fish and wildlife habitat-the proceedings of a national

symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS/-87/76, p 13-34. (1978), 11 Fig, 2 Tab.

Descriptors: *Evaluation, *Systematics, *Design, Aquatic habitats, Terrestrial habitats.

Many needs for classification and many different classification systems exist. A common framework for classifictionis neceassary. Users and user requirements of classification systems are listed. The functional role of classification is formally established via a problem solving model. Three approaches to classification: identifying and classifying environments by components such as soil, vegetation, etc., integrating via the permultations of two or more components; and regionalizing the classifying and delineatin space based on environmental relationships. Characteristics of a classification framwork are; a family of related classification systems are needed since a single system cannot cover all needs; this family should consist of such stable components as bedrock, soil, etc.; each of these components should be hierarchiecally classified; classifications which are regionalizations or integrations should be designed for a stated purpose; experience, knowledge, and data should be identified, labeled, and stored by the component classification; applied classifications should be validated against the their stated purpose; and the logic and language of all classifiction should be communicable to the nonspecialist. (See also W80-01897) (Otello-Mass)
W80-01898

A DIGITIZED CLASSIFICATION SYSTEM FOR THE NATURAL VEGETATION OF NORTH AMERICA WITH HIERARCHICAL SUMMARY FOR WORLD ECOSYSTEMS,
Arizona Game and Fish Dept., Phoenix.
For primary bibliographic entry see Field 6B.
W80-01905

A DATA COMPILATION PROGRAM FOR WETLAND EVALUATION,
Beak Consultants, Inc., Portland, OR.
For primary bibliographic entry see Field 6B.
W80-01907

MONITORING AREAWIDE RURAL WATER QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W80-01976

THE CULTURE COLLECTIONS OF ALGAE AT THE UNIVERSITY OF TEXAS AT AUSTIN,
Texas Univ. at Austin. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W80-01981

7C. Evaluation, Processing and Publication

COMPUTER MODELS TO PREDICT GROUND WATER CHANGES,
For primary bibliographic entry see Field 7A.
W80-01682

WATER RESOURCES INVESTIGATIONS IN NEW YORK-1978,
Geological Survey, Albany, NY. Water Resources Div.
A. J. Finch.
Geological Survey New York District report, 1979. 57 p, 7 Fig.

Descriptors: *Water resources, *Investigations, *New York, *Projects, *Reviews, Programs, Surface waters, Groundwater, Water quality, Bibliographies, Publications, *U.S. Geological Survey, *Water Resources Division.

This report relates the functions of the Water Resources Division of the U.S. Geological Survey and describes in some detail its work in the State of New York during 1978. The New York District office is located in the U.S. Post Office and Courthouse in Albany. Subdistrict offices are located in Syosset. Ithaca, and Albany, with field offices in Middletown and Potsdam. A bibliography of reports published or released in 1978 by the New York District is included. (Woodard-USGS)
W80-01702

STORAGE COEFFICIENTS FROM GROUND WATER MAPS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Civil Engineering.
B. M. Sahni, and H. S. Seth.
Journal of the Irrigation and Drainage Div., Proceedings of the American Society of Civil Engineers, Vol 105, No IR2, p 205-213, June, 1979. 4 Fig, 6 Ref.

Descriptors: *Storage coefficient, *Maps, *Potentiometric level, Transmissivity, Aquifer testing, Observation wells.

The construction of observation wells for aquifer tests is expensive and time-consuming. Transmissivity, but not the storage coefficient, can be estimated from the pumping well data alone. A method is proposed for the determination of the storage coefficient from the slopes of the ground water piezometric surface and the aquifer transmissibility. Two sets of piezometric contour maps are drawn from data recorded at an interval of a few days at a few selected points. These maps determine whether the slope of the piezometric surface is constant. The method was applied to an actual field problem and the results compared favorably with those obtained from aquifer test data. (Purdin-NWWA)
W80-01736

A CASE STUDY OF DRAINAGE INVESTIGATIONS AT GOVERNMENT AGRICULTURAL FARM, HANSI AND ITS ADJOINING AREAS,
Haryana Agricultural Univ. (India).
For primary bibliographic entry see Field 2F.
W80-01808

PERFORMANCE OF A F.R.P. PAN EVAPORIMETER,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2D.
W80-01829

ANNOTATED BIBLIOGRAPHY: WETLANDS VALUE STUDY.
Eastern Michigan Univ., Ypsilanti. Dept. of Geography and Geology.
E. Jaworski, C. N. Raphael, D. L. Tilton, R. H. Kadlec, and B. R. Schwegler.
Michigan Department of Natural Resources, Division of Land Resource Programs. July, 1977. 369 Ref.

Descriptors: *Abstracts, *Michigan, *Wetlands, Coastal marshes, Bibliographies, Reviews, Economics, Value.

Over three hundred abstracts are given on the ecological functions and economic values of wetlands, with particular emphasis on Michigan's coastal wetlands. (Steiner-Mass)
W80-01931

8. ENGINEERING WORKS

8A. Structures

SLOW SAND FILTERS FOR THE LEYTE METROPOLITAN WATER DISTRICT,
Trans-Asia, Manila (Philippines).
For primary bibliographic entry see Field 4A.
W80-01648

PERFORMANCE MATCHING AND OPTIMIZATION OF WIND POWERED WATER PUMPING SYSTEMS,
Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 8C.
W80-01711

PRIMITIVE WELL DRILLING TECHNIQUES - PART I,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol. 33, No. 10, p 44-46, September 1979. 4 Fig.

Descriptors: *Drilling, *History, *Drilling equipment, Technology, Boreholes, Saline water, Water wells.

In developing countries, primitive drilling techniques may be more useful and beneficial than modern methods. Percussion drilling systems were developed in different parts of the world, but the basic tools used were similar and have not changed much in the last 3000 years. Three basic power systems were used: the springboard, springpole, and walking beam. The Chinese springboard system used a crew of laborers who jumped on and off one of a plank. The drilling tools were tied to the opposite end and were raised and lowered at a rate of twenty to forty strokes per minute. The Amerian springpole system consisted of a long, straight pole which supported the tools and generated a lifting/dropping motion. A stirrup device attached to the drilling line allowed two or three men to kick down on the pole to produce the reciprocal percussive motion. With the advent of steam power, the springpole method was replaced by the walking beam which was raised and lower with mechanical (steam) power. The walking beam was the forerunner of the potable drilling rig. (Purdin-NWWA)
W80-01741

LIFTING DEVICE FOR WATER, WASTE WATER, SLUDGE AND THE LIKE,
Maschinenfabrik Hellmut Geiger, Karlsruhe (Germany, F.R.).
B. Botsch, and W. Marzluf.
U.S. Patent No. 4,136,636, 6 p, 8 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 123, August 7, 1979.

Descriptors: *Patents, *Water conveyance, Conveyance structures, Treatment facilities.

The invention relates to a conveying device for the conveyance of water or of aqueous liquids and in particular to a device for the conveyance of waste water, by means of a conveying wheel which includes conveying cells arranged in circular form. The characteristic feature is that in the upake region, the conveying wheel, which is provided with one-sidedly open cells lying in a plane perpendicular to the axis of rotation, dips into the level of liquid; that at least the region of the upward conveyance is covered over by a stationary wall portion, which closes off the one-sidedly open cells of the conveying wheel along the conveying route; and that in the discharge region a receiving vessel is located, the leading edge of which extends in axial direction up to the edge of the conveying wheel. (Sinha-OEIS)
W80-01939

8B. Hydraulics

STORAGE COEFFICIENTS FROM GROUND WATER MAPS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W80-01736

STEADY SUPERCRITICAL FLOW DOWN AN INCLINED PLANE,

Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
F. Engelund.
In: Progress Report No 48, p 25-30, April 1979. 3 Fig, 1 Tab, 1 Ref.

Descriptors: *Supercritical flow, *Open channel flow, *Flow, Steady flow, Model studies, Mathematical studies, Orifices, Theoretical analysis, Analytical techniques, Analysis, Laboratory tests, Foreign research, Inclined plane.

The problem discussed was the spreading of a steady flow discharged from a rectangular orifice at the top of an inclined plane. The character of this three-dimensional flow is so complicated that a theoretical solution is not readily available, but certain important information may be obtained by a dimensional analysis. For the sake of simplicity, only supercritical flow was considered. The analysis was based on experiments. To obtain a set of approximate equations describing the flow, the two components of the momentum equation considered were in the direction of the jet axis and at 90 degrees to the jet axis. In the experiments the dimensions of the rectangular outlet were 200 x 25 mm, the slope was either 3.3 deg or 7.65 deg, and the Manning number was 70 m to the 1/3 power/s. The Froude number at the outlet varied from 2.6 to 7. The depth, y, was measured by point gage and varied between 25 and 5 mm. Even when the basic equations are considered non-parametric, complete similarity cannot be expected close to the outlet because its geometrical proportional does not automatically correspond to the scaling defined by the analysis. Correction was made by introducing a distance delta x between the theoretical origin of x and the outlet section, determined to give the best fit. The use of relevant scaling reduced the scatter to an acceptable level, particularly where the width is concerned. For the depth, the scatter is somewhat larger, which is not surprising as the experimental accuracy in the determination of y is much smaller. (Humphreys-ISWS)
W80-01812

AN EXPERIMENTAL STUDY OF HYDRAULIC AND GEOMORPHIC CHANGES IN AN ALLUVIAL CHANNEL INDUCED BY FAILURE OF A DAM,
Colorado State Univ., Fort Collins. Engineering Research Center.
For primary bibliographic entry see Field 2E.
W80-01816

WAVE MOTION IN ROCKFILL EMBANKMENTS,
New Orleans Univ., LA. School of Engineering.
A. A. Hannoura, and J. A. McCorquodale.
Advances in Water Resources, Vol 2, No 3, p 149-152, September 1979. 9 Fig, 5 Ref.

Descriptors: *Embankments, *Waves(Water), *Model studies, *On-site investigations, Mathematical models, Finite element analysis, Analytical techniques, Rocks, Rockfill dams, Porous media, Water levels, Water level fluctuations, Hydraulics, Rockfill embankments, Wave motion.

A combined, finite element method of characteristics was used to simulate wave motion in sloping multilayered embankments. Experimental investigation was undertaken to obtain representative interface boundary conditions and to verify the numerical model. The numerical and experimental results of the internal water surface were in good agreement. Further study is needed to refine the interface boundary conditions. (Sims-ISWS)
W80-01848

DIRECT ANALYTICAL SOLUTIONS FOR APPROXIMATE SURGE ANALYSIS,
Memorial Univ. of Newfoundland, St. John's. Faculty of Engineering and Applied Science.
E. Moore, and J. J. Sharp.
Advances in Water Resources, Vol 2, No 3, p 145-147, September 1979. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Surges, *Surge tanks, *Reservoirs, *Mathematical models, Model studies, Tunnels, Tunnel hydraulics, Water tanks, Equations, Mathematics, Hydraulics, Calculators, Calculators equations.

The derivation, and validity, of the basic differential equations for variation of water level in simple surge tanks has been adequately described and documented. Surge heights were calculated from a dynamic equation and from a continuity equation. If friction is assumed to be negligible, a direct solution is available. But in all other cases, it is necessary to solve the equations by numerical techniques. A finite difference approach is commonly employed, but accuracy is achieved only if the time increment is small in which case computation costs may be excessive. The logarithmic method overcomes this problem, but it provides only maximum and minimum values for surge heights and suffers from the disadvantage that it requires an iterative solution. Despite the advances which have been made, however, the only straightforward, non-iterative methods which have received general acceptance are based on the finite difference approach using a digital computer. Still there are disadvantages. The cost is high. Not all engineers have quick and easy access to a computer, and, if a problem is in the design stage, the analysis of trial configurations is best handled by a system giving immediate answers. Other alternatives are available, however. Hand calculators have become cheap. Problems previously handled by computers can be tackled with ease, although step-by-step numerical integration still causes difficulty. Calculators are most useful when a set of fundamental equations can be re-arranged to give an exact direct solution or, if this is not possible, when an approximate solution can be obtained. In this paper it was shown that the transformation of equations into approximate equations capable of direct solution leads to answers comparable to those achieved using conventional methods. The equations developed are easily solved on hand calculators and are, therefore, particularly useful in the design stage where the main characteristics of a number of proposals can be quickly established. (Sims-ISWS)
W80-01849

HEAT RECIRCULATION INDUCED BY THERMAL DIFFUSERS,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-01879

SHEAR-STRESS DISTRIBUTION IN STABLE CHANNEL BENDS,
Calgary Univ. (Alberta). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01880

8C. Hydraulic Machinery

PERFORMANCE MATCHING AND OPTIMIZATION OF WIND POWERED WATER PUMPING SYSTEMS,
Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
G. N. Brogg, and W. L. Schmidt.
Energy Conversion, Vol 19, No 1, p 33-39, January, 1979. 6 Fig, 1 Tab, 7 Ref.

Descriptors: *Pumps, *Windmills, *Wind velocity, *Power system operation, Pump turbines, Performance, Design criteria, Optimization, Efficiency.

A systematic approach for matching windmills and waterpumps to give optimum performance is presented using dimensional analysis techniques. Input data for the analysis include: wind speed frequency and duration; pumping parameters; and windmill and pump characteristics. Most pumps and wind turbines have optimum characteristics within a given operating range. When this information is available, the best pump and windmill for a specific application can be selected, and the design and off-design performance of the total system can be predicted. Generally, the best system will provide the required amount of water with a minimum cost and maximum availability. The concept of power specific tip speed is introduced. This is used to facilitate the matching of windmills and pumps at the design wind velocity in a general manner for a variety of situations. (Purdin-NWWA)
W80-01711

GROUND WATER HEAT PUMPS - THE NEW ALTERNATIVE,
Western Ground-Water Consultants, Winnipeg (Manitoba).
J. Phimister.
Canadian Water Well, Vol 5, No 3, p 22-23, August, 1979. 1 Fig.

Descriptors: *Heat pumps, *Ground water, *Canada, Heating, Energy, Efficiency, Non-Consumptive use.

Ground water is a rapidly renewable, easily accessible, widespread, non-polluting energy source when used in conjunction with a heat pump. A ground water heat pump has a coefficient of performance (COP) of about 3. COP is the ratio of energy output to energy input. The quantity of heat required for a specific application determines the required pumping rate. Since the ground water is returned to the aquifer, there is no consumptive use. The abundance of ground water and the high energy requirement for heating in Canada (65 percent of all energy consumed) makes the ground water heat pump system a viable space heating alternative that should be fully developed as soon as possible. (Purdin-NWWA)
W80-01718

CAUSES AND EFFECTS OF 3-PHASE POWER SYSTEM UNBALANCE,
Water Systems Council, Chicago, IL.
Ground Water Age, Vol 13, No 11, p 22-24, 40, July, 1979.

Descriptors: *Pumps, *Electrical motors, *Electrical design, Electric currents, Power transformers, Rotors, Electrical equipment, Voltage regulations.

Cuases of unbalanced voltages on submersible pump motors include: overloading the transformers with single phase loads; unsymmetrical transformer banks; unsymmetrial or overloaded distribution lines; unsymmetrical feeders to the motor. Some problems caused by unbalanced voltages are: excessive current in one or more stator windings; overheating of the rotor; noise and torsional vibration in the motor and load. Graphs are presented showing the current unbalance and the increase in winding loss in the hottest phase of the machine for a given amount of voltage unbalance. There seems to be no economical solution to the unbalanced problem and detailed analytical study of each individual problem does not seem feasible. However, most problems that occur can be either solved or avoided by conservative sizing and good practice with respect to both the motor and the distribution system components. Advance information about the likelihood of voltage unbalance in a particular distribution system can serve as a basis for sizing the motors and the protective circuitry. Power distribution systems using open wye-open delta transformer banks to supply induction motors should receive special attention to insure that both line and transformer impedences are kept to a minimum and transformer size matches the load. (Purdin-NWWA)
W80-01730

ELECTRIC GENERATING WATER POWER DEVICE.
U.S. Patent No 4,163,905, 11 p, 10 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 203-204, August 7, 1979.

Descriptors: *Patents, *Electric power production, Electrical equipment, Subsurface waters, Generators, Currents(Water).

The object of the invention is to provide a submerged water power machine employing rows of blades arranged in an endless path configuration

for converting water current energy into movements of the blades, the blades being supported at their tops and bottoms for holding them in stable working positions and the blades providing a very large working area exposed to the moving water currents so that the machine has relatively high capacity and is of reasonably confined bulk, as well as being relatively inexpensive to maintain in operating condition and requiring a minimum amount of human supervision. (Sinha-OEIS)
W80-01932

UNDERSTREAM TURBINE PLANT,
L. Skendrovic.
U.S. Patent No 4,163,904, 9 p, 6 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 203, August 7, 1979.

Descriptors: *Patents, *Electric power production, *Electric equipment, *Currents(Water), Ocean currents, Turbines, Underflow, Subsurface waters, Gulf Stream.

An understream turbine plant is provided for generating electrical power by means of the flow of an understream effluent, such as the Gulf Stream off the Atlantic seaboard coast. Each turbine plant has a large central opening with a large turbine impeller within it. An electrical generator is mounted with the water-tight housing of the plant adjacent to the central opening. The opening of the plant has a large diameter forward entrance and a large diameter rearward exit with a central portion of smaller diameter. The impeller of the turbine plant is mounted in the smallest diameter part of the opening. The contour of the opening provides for a Venturi effect increasing the efficiency of plant operation. A number of plants may be provided to span at least a portion of the understream flow, as well as being placed in a stacked arrangement to span at least a portion of the height of the understeam flow. Special bearing seals for the rotating impeller prevent the ocean water from entering the interior of the turbine housing. (Sinha-OEIS)
W80-01933

8I. Fisheries Engineering

INITIAL IMPACTS OF EXPERIMENTAL FISH INTRODUCTIONS ON THE MACROZOOPLANKTON OF SMALL OLIGOTROPHIC LAKES,
British Columbia Univ., Vancouver. Faculty of Forestry.
For primary bibliographic entry see Field 5G.
W80-01767

APPLICATION OF STREAM ECOLOGY TO RAISING SALMON SMOLTS IN HIGH DENSITY,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 5G.
W80-01768

DIET OF BROOK TROUT (SALVELINUS FINTINALIS MITCHELL) AND BROWN TROUT (SALMO TRUTTA L.) IN AN ALPINE STREAM,
Maryland Univ., College Park, Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W80-01770

RISE AND COLLAPSE OF AN INTRODUCED FISH, MORNONE MISSISSIPPIENSIS IN CLEAR LAKE, IOWA,
Iowa State Univ., Ames. Dept of Animal Ecology.
For primary bibliographic entry see Field 5C.
W80-01771

FEEDING BEHAVIOR AND TERRESTRIAL LOCOMOTION IN THE CYPRINODONTID FISH, RIVULUS HARTII (BOULENGER),
University of Western Ontario, London. Dept. of Zoology.
B. H. Seghers.
In: Proceedings: Congress in Denmark 1977 Part 3, 1977; Internationale Vereinigung fur Theoretische und Angerwandte Limnologie, Vol 20, 1978, p 2055-2059. 5 Fig, 1 Tab, 11 Ref.

Descriptors: *Petite Curucaye River(Trinidad), *Standing waters, *Killifishes, *Fish behavior, *Fish food organisms, *Predation, Trinidad, West Indies, Ponds, Minnows, Fish, Fish diets, Aquatic environment, Fish establishment, Fish migration, Fish physiology, Fish populations, Fish types, Aquatic insects, Length, Fisheries.

A tropical fish, Rivulus hartii forages effectively on insect fauna on overhanging vegetation by aerial jumping; this terrestrial feeding behavior, coupled with excellent land mobility, explains its unusually high biomass in small, often temporary, remote aquatic habitats in northern Trinidad, West Indies. One typical stream containing several small pools with a maximum depth 8-28 cm, the Petite Curucaye River, a tributary of Santa Cruz River, was observed 1967-1977. The 35 m experimental section contains 245 Rivulus and 464 guppies, and Poecilia reticulata, the only other fish present. Biomass is 124.3 kg/ha for Rivulus and 37.1 kg/ha for Poecilia. The largest observed Rivulus was 90 mm long and 11.4 g; most were 10-30 mm long. Main food organisms include Formicidae, Coleoptera adults, and juvenile Poecilia. Rivulus also captures ants and other insects on overhanging vegetation up to 14 cm above the water surface. Maximum horizontal jump is 56 cm and maximum distance covered in five minutes is 363 cm. Most fish explore the area systematically, suggesting that jumps are not random movements. Rivulus appearance in remote temporary forest pools is explained by adult fish moving on damp land. Rivulus occur at very low densities in large rivers, since numerous piscivores are present. Jumping behavior in rivers probably serves as an antipredator function and its role in feeding and overland movement is of secondary importance. (Danovich-Wisconsin)
W80-01772

EFFECT OF FISH (SALVELINUS ALPINUS, ARCTIC CHAR) PREDATION ON THE ZOOPLANKTON IN TEN NORWEGIAN LAKES,
Trondheim Univ. (Norway). Museum.
For primary bibliographic entry see Field 5C.
W80-01773

REMARKABLE YIELD OF BROWN TROUT (SALMO TRUTTA L.) IN LAKES NEAR THE HARDANGER GLACIER, NORWAY,
Trondheim Univ. (Norway). Museum.
For primary bibliographic entry see Field 5C.
W80-01774

VERTICAL DISTRIBUTION OF FISHES IN ONE LAKE DEEP (LAKE KUUSVESI, CENTRAL FINLAND),
Jyvaskyla Univ. (Finland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W80-01777

POPULATION STUDIES OF VENDACE (COREGONUS ALBULA (L.) AND PERCH (PERCA FLUVIATILIS L.) IN A MESOHUMIC OLIGOTROPHIC LAKE,
Joensuu Univ. (Finland). Karelian Inst.
For primary bibliographic entry see Field 5C.
W80-01779

RESPONSE OF A LAKE WHITEFISH (COREGONUS CLUPEAFORMIS) POPULATION TO EXPLOITATION,
Fisheries and Marine Service, Nanaimo (British Columbia).
For primary bibliographic entry see Field 6G.
W80-01789

CHANGES IN THE CHEMICAL COMPOSITION, CALORIFIC AND WATER CONTENT OF YELLOW PERCH FRY, PERCA FLUVIATILIS FLAVESCENS,
Manitoba Univ., Winnipeg. Dept. of Zoology.
M. A. Henderson, and F. J. Ward.
In: Proceedings: Congress in Denmark 1977, Part 3, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 2025-2030, 3 Fig, 16 Ref.

Descriptors: *Yellow perch, *West Blue Lake(Manitoba), *Growth rates, *Period of groth, *Fry, *Fisheries, Perches, Fish, Freshwater fish, Canada, Animal physiology, Biochemistry, Growth stages, Juvenile fish, Fish eggs, Life cycles, Carbon, Nitrogen, Length, Weight, Hatching.

Changes in body content carbon (C), nitrogen (N), and calorific content of yellow perch (Perca fluviatilis flavescens) fry tissues in West Blue Lake, Southwestern Manitoba during summers 1974-1975, can be related to immediate energy requirements of newly hatched fish. Later changes in body C, N, and calorific values are associated with continued development, specifically skeleton mineralization and scale formation. Initial decrease in C content from 515 micro g C/mg Dwt on DAH3 (days after hatching) to 430 micro g C/mg Dwt on Dah21 and increase in N content from 78 micro g N/mg Dwt on Dah3 to 106 micro g N/mg Dwt on Dah21 is related to initial yolk utilization. C values represent fat and carbohydrate in yolk; N values represent yolk protein. Body C content after DAH50 declines to 410 micro g C/mg Dwt as the fish returns from pelagic to littoral zones. A similar decline occurs after DAH50 in body N content, from 105 micro g N/mg Dwt to 83 micro g N/mg Dwt by DAH74. This accounts for the stable C:N ratio which is initially 6.6 due to high C and low N levels, but by DAH21 the ratio is 4.1 and ranges from 3.9 to 4.3 until sample discontinuation on DAH74. Initial increase in water content from 5.1 to 8.8 micro g H20/micro g Dwt by DAH14, and subsequent decline to 4 mg H20/mg Dwt, although associated with growth and development, are not direct evidence of changing metabolism. (Danovich-Wisconsin)
W80-01790

FISH COMMUNITIES OF THE MANITOULIN ISLAND LAKES,
Toronto Univ. (Ontario). Dept. of Zoology.
H. H. Harvey.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 2031-2038. 5 Fig, 2 Tab, 9 Ref.

Descriptors: *Manitoulin Island, *Lakes, *Freshwater fish, *Animal groupings, *Ecological distribution, *Fisheries, *Basic data collections, Lake Huron, Distribution, Distribution patterns, Perches, Pikes, Shiners, Sunfishes, Fish, Coldwater fish, Fish populations, Fish types, Regression analysis, Systematics, Biological communities, Speciation.

Five major fish communities were identified on Manitoulin Island, which has 70 lakes larger than 0.5 km in length and is situated in northern Lake Huron; Manitoulin fish communities are related to lake physical features, especially area and depth. Clustering the 27 fish species by lakes yields three major groupings: cold-water species, frequently occurring warm-water species, and occasional and rare warm-water species. Clustering lakes by fishes yields eight major lake groups. For example, cold-water fishes induce a group of the largest and deepest lakes. Combining these two dendrograms yields a matrix and five fish associations are apparent: (1) Six fish species: northern pike, bluntnosw minnow, yellow perch, Iowa darter, rock bass, small-mouth bass occur most commonly. This community is the major force forming some lake clusters. (2) Thirteen species: rainbow trout, brook trout, brown trout, lake trout, trout perch, burbot, sand shiner, splake, longnose sucker, rainbow smelt, spottail shiner, lake whitefish, lake herring, and wall-eye occur only in deepest lakes and are the cold-water fish community. (3) Seven species: white sucker, johnny, darter, blacknose shiner, common shiner, pumpkinseed, mimic shiner, mottled sculpin, are weakly associated with a number of lakes. (4) Golden shiner and blackchin shiner are present in another lake grouping, (5) Five species:

central mudminnow, northern redbelly dace, brook stickleback, finescale dace, and fathead minnow are very common in small to medium sized shallow lake. (Danovich-Wisconsin)
W80-01791

A NOTE ON AGING IN FISH WITH SPECIAL REFERENCE TO THE PERCH, PERCA FLUVIATILIS L.,
Freshwater Biological Association, Ambleside (England).
J. F. Craig.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 2064. 3 Fig, 22 Ref.

Descriptors: *Windermere, Great Britain, *Fish reproduction, *Animal growth, *Perches, *Aging(Biological), Fish physiology, Growth rates, Growth stages, Nutrient temperature, Water temperature, Energy, Age, Life history studies, Metabolism, Sexual maturity, Gonads, Size, Longevity, Mature growth stage, Fisheries.

This paper compared growth and aging in 1959 and 1968 year-classes of Windermere perch and concludes that aging is best described by nutrition and growth rather than chronological age. Slow fish growth caused by poor food supply, cold temperatures, overcrowding or a combination of these, implies longer life expectancy than fast fish growth although females grwo faster and live longer than males. April energy contents for total weight and somatic weight at each age for 1959 and 1968 year-class female perches show that energy demand for reproduction increase with age. Gonad-to-somatic ratio curves are very similar for each year-class; although fast growing fish produce large gonads in proportion to soma, energy quantities are no greater than in slow growing sih. It is assumed that energy value per gram of ovary remains constant with age. While early death in fast growing population may not result directly from over-reproduction, this may be the case in slow growing populations. Apparently, fish longevity correlates directly to growth rates. (Danovich-Wisconsin)
W80-01792

GENETIC DIFFERENTIATION BETWEEN VENDACE (CORRGONUS ALBULA (L.)) POPULATIONS IN EASTERN FINLAND,
Joensuu Univ., (Finland). Karelian Inst.
J. Vuorinen, and P. Lankinen.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 2111-2116. 2 Fig, 4 Tab, 9 Ref.

Descriptors: *Vendace, *Finland, *Fish populations, *Fish genetics, Salmonids, Genetics, Spawning, Fish reproduction, Lakes, Fish behavior, Electrophoresis, Fish migration, Fish physiology, Biochemistry, Enzymes, Correlation analysis, Mode of action, Variability, Heterogeneity, Fisheries, Lake Suomunjarvi(Finland), Lake Kahjoonjarvi(Finland).

Genetic variation studies during 1975-1976 between vendace populations living in a limited area, eastern Finalnd, but having been isolated 10,000 years, show that allele frequency differences between lakes is due to selection pressure, assuming that migration occurs. Seven lakes were studied; spawning time varies from October for Lake Koitere, end of December for Lake Suomunjarvi, and October and April (sympatric populations) in Lake Kajoonjarvi. Standard horizontal starch gel electrophoresis techniques were used for assays of liver, muscle, and heart enzymes. About half the vendace loci studied were polymorphic, and the same allele is the common one in all populations. However, the observed polymorphism is unequally distributed. Mean genetic distance between each lake pair is 0.023 and mean heterozygosity for the five polymorphic loci is 0.21. From total variation, 10% is due to lake variability. Populations differences are explained by either random populations drift or selection differences on different alleles in different lakes. However, if more than one individual vendace migrates from lake to lake, population differences are explained by selection pressure rather than random drift. Migration between adjacent lakes reduces divergence between a pair of lakes. Lake Kajoonjarvi has two genetically isolated populations since non-overlapping spawning times are probably heritable; some evidence occurs for differentiation at alpha-Gpdh-1 locus. Differentiation amounts at a locus do not correlate with that locus heterozygosity value. (Danvoich-Wisconsin)
W80-01793

INFLUENCE OF STARVATION ON WHITEFISH (COREGONUS LAVARETUS L.) LARVAE,
B. Jezierska, M. Korwin-Kossakowski, and G. Jowko.
In: Proceedings: Congress in Denmark, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 2134-2136. 2 Fig, 4 Ref.

Descriptors: *Salmonids, *Mortality, *Food abundance, *Feeding rates, *Larval growth stage, *Laboratory techniques, Growth stages, Growth rates, Fish establishment, Longevity, Metabolism, Period of growth, Fish hatcheries, Fish management, Fry, Fish diets, Respiration, Oxygen requirements, Oxygen demand, Fisheries.

Laboratory starvation experiments in 1976 and 1977 show that whitefish larvae must be transferred from hatcheries to water bodies containing natural food no later than 15 days after hatching. If food concentration in the water body is low, whitefish larvae transfer should be made even earlier. Experiment temperatures are kept at constant 10C and freshwater zooplankton and Artemia salina nauplii are food sources. Highest survival rates occur when fish larvae are supplied with food since the first day of life, however, after one month, survival never exceeds 50%. Most active food intake occurs when first food is given between the 8th and 10th day of life. When first food contact takes place more than 10 days after hatching, some larvae have difficulty catching flood organisms; on the 18th day, few larvae can catch prey. Larvae fed on the 10th and 15th day after hatching survive at a lower rate, 25%. First feeding on the 16th or 20th day, results in 100% mortality; the longer the delay in first feeding, the sooner death occurs. Starving fish larvae oxygen consumption is similar up to the 16th day, then starving larvae decrease their oxygen consumption, indicating changes in metabolic rate. The 25th day after hatching, when mortality of starved larvae is 50%, their respiration rate amounts to one-third the respiration rate of the same age normally fed larvae. (Danovich-Wisconsin)
W80-01794

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

THE CULTURE COLLECTIONS OF ALGAE AT THE UNIVERSITY OF TEXAS AT AUSTIN,
Texas Univ. at Austin. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W80-01981

10. SCIENTIFIC AND TECHNICAL INFORMATION

10D. Specialized Information Center Services

FLOODPLAIN SERVICES AVAILABLE FROM THE ILLINOIS STATE WATER SURVEY,
Illinois State Water Survey, Urbana.
J. P. Lardner, J. L. Alexander, and M. L. Terstriep.
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Descriptors: *Illinois, *Flood plains, *Data collections, *Documentation, Flood protection, Hydrologic data, Flood stages, Information retrieval, Information exchange, Flood discharge.

Although the administration of the state floodplain regulations and most local assistance relating to floodplains have been provided by the Illinois Division of Water Resources, certain other services are provided directly by the Illinois State Water Survey (ISWS). These services include: (1) a repository of all available floodplain information, (2) coordination of 100-year discharges through a review and certification procedure, and (3) participation in a state review of floodplain studies and the determination of 'best available elevation data' for local floodplain regulation. It is the purpose of this publication to describe these ISWS services and the means by which they are made available to the public. The Floodplain Information Respository is a surface water report library kept by the ISWS. These reports, currently (1979) numbering over 300, have been submitted by various private, state, and federal agencies. Bibliographic information and applicable keywords have been extracted from each report and entered into the system. The system includes (1) copies of actual surface water reports (if available), (2) a data retrieval computer program, and (3) Data Entry Forms (DEF). The ISWS is responsible for reviewing and coordinating 100-year discharges. Participation in this program as well as the methods used in the program and the eventual certification of 100-year discharges were described. The ISWS also provides a comprehensive 'Local Assistance' program and participates in the 'State Review Procedure' for flood insurance and other regulatory floodplain studies. Procedures for a community needing this assistance were described. (Humphreys-ISWS)
W80-01800

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